Proceedings of the American Academy of Arts and Sciences.

VOL. 62. NO. 9.—MAY, 1928.

(TITLE PAGE AND TABLE OF CONTENTS.)

RECORDS OF MEETINGS.

One thousand one hundred and forty-ninth meeting.

OCTOBER 13, 1926.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present fifty-one Fellows and Associates and sixteen guests.

The Records of the Annual Meeting, of May 12, were read and approved.

The following letters were presented by the Corresponding Secretary: from Roger Adams, F. W. Benson, W. G. Cady, E. J. Cohn, E. B. Mathews, G. R. Minot, and H. J. Spinden, accepting Fellowship; from J. A. Cousens, accepting Associate Membership; from H. M. Buck, declining Associate Membership; and from H. C. Bumpus, resigning Fellowship.

The Corresponding Secretary reported that the Council had voted to reappoint the Committee on Associates, consisting of Edwin B. Wilson, chairman, W. C. Wait, and Thomas Barbour, with power to add to its membership and to consider not only the matter of Associates but also Fellows and Foreign Honorary Members.

The Corresponding Secretary reported the receipt from the American Council of Learned Societies of announcements of the 1927 competition for the Small Grants in Aid of Research in the Humanistic and Social Sciences.

It was announced that the President had appointed President W. W. Campbell, of the University of California, as the delegate of the Academy at the inauguration of the new President of the University of Oregon, on October 18.

The President announced the death of six Fellows:—William Sturgis Bigelow (Class III, Section 4), Charles William Eliot (Class I, Section 3), Desmond FitzGerald (Class I, Section 4), George

Richard Lyman (Class II, Section 2), Charles Vancouver Piper (Class II, Section 2), and William Jewett Tucker (Class III, Section 1).

The newly elected Fellows were then presented.

The following communications were presented:

Recent Progress in Anthropological Research:

1. Mr. Earnest A. Hooton: "Studies in Race-Mixture."
2. Mr. Alfred V. Kidder: "Southwestern Anthropology."
3. Mr. Herbert J. Spinden: "Astronomy of the Mayas."

Illustrated with lantern slides.

The Meeting was dissolved at ten P. M.

One thousand one hundred and fiftieth meeting.

NOVEMBER 10, 1926.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present twenty-seven Fellows and Associates.

The Records of the meeting of October 13 were read and approved.

The Corresponding Secretary presented a letter from Norbert Wiener, accepting Fellowship.

The receipt of a biographical notice of Charles Francis Jenney, by A. P. Rugg, was reported by the Corresponding Secretary, who also announced that the President had appointed Professor A. B. Hart to represent the Academy at the Centennial celebration of Western Reserve University.

The President announced that copies of a pamphlet relating to Small Grants in Aid of Research in the Humanistic and Social Sciences, issued by the American Council of Learned Societies, were to be had of the Assistant Librarian.

The following communications were presented:

The Development of Fine Arts Teaching at Harvard:

1. Mr. Edward W. Forbes: "Technical Problems."
2. Mr. A. Kingsley Porter: "Publications."
3. Mr. Paul J. Sachs: "The Museum."

The Meeting was dissolved at ten P. M.

One thousand one hundred and fifty-first meeting.

DECEMBER 8, 1926.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present thirty-five Fellows and Associates and five guests.

The Records of the meeting of November 10 were read and approved.

The Corresponding Secretary presented an invitation from the Secretary of the American Council of Learned Societies to send a representative to the meeting of secretaries of the constituent societies on January 28, and announced that the Council had asked the Recording Secretary to represent the Academy.

The President announced the death of three Fellows:—Paul Revere Frothingham (Class III, Section 1), James Furman Kemp (Class II, Section 1), and Forris Jewett Moore (Class I, Section 3).

The following communication was presented:

Dr. Hans Zinsser: "The Principles Underlying the Specific Prevention and Treatment of Infection," illustrated with lantern slides.

Three papers were presented by title:

"Contributions to Mineralogy from the Department of Mineralogy and Petrography, Harvard University. 12. Catalogue of the Collection of Meteorites in the Mineralogical Museum of Harvard University," by Charles Palache.

"Studies in the Urea Series," by T. L. Davis and A. J. J. Abrams.

"On the Distribution of Intensity in Stellar Absorption Lines," by C. H. Payne and Harlow Shapley.

The Meeting was dissolved at 9.45 P. M.

One thousand one hundred and fifty-second meeting

JANUARY 12, 1927.—STATED MEETING

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present thirty-three Fellows and Associates and four guests.

The Records of the meeting of December 8 were read and approved.

The Corresponding Secretary reported the receipt of biographical notices of Sir Joseph Dalton Hooker, by B. L. Robinson, and of Charles Robert Cross, by Elihu Thomson.

The President announced the death of Addison Emery Verrill, Fellow in Class II, Section 3.

On recommendation of the Council, it was

Voted, To appropriate the sum of $300 from the General Fund for the use of the House Committee.

The following communications were presented:

Mr. Vannevar Bush: "Recent Advances in Electrical Engineering."

Mr. Charles L. Norton: "The Appreciation of Science by Industry."

The Meeting was dissolved at 9.30 P. M.

One thousand one hundred and fifty-third meeting.

FEBRUARY 9, 1927.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present thirty-nine Fellows and Associates and twenty-three guests.

The Records of the meeting of January 12 were read and approved.

The Corresponding Secretary reported the receipt of a biographical memoir of Arthur Gordon Webster by E. H. Hall.

The President announced the death of two Fellows:—Simeon Eben Baldwin (Class III, Section 1), and James Ford Rhodes (Class III, Section 3).

The Recording Secretary presented a brief report on the meeting of the American Council of Learned Societies in New York on January 29.

The following communication was presented:

Mr. Robert W. Wood and Mr. Alfred L. Loomis: "The Physical, Chemical and Biological Effect of High-Frequency Sound Waves," with lantern illustrations.

Three papers were presented by title:

"Ants of the Genus Amblyopone Erichson," by W. M. Wheeler.

"The Ants of the Canary Islands," by W. M. Wheeler.

"The Ants of Lord Howe Island and Norfolk Island," by W. M. Wheeler.

The Meeting was dissolved at 10.10 P. M.

One thousand one hundred and fifty-fourth meeting.

MARCH 9, 1927.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present twenty-four Fellows.

The Records of the meeting of February 9 were read and approved.

The Corresponding Secretary reported the receipt of biographical memoirs of Charles William Eliot, by E. H. Hall, George Richard Lyman, by G. P. Clinton, and of Forris Jewett Moore, by H. P. Talbot.

The President announced the appointment of Professor William Duane to represent the Academy at the 200th Anniversary of the American Philosophical Society, at Philadelphia, April 27 to 30.

The President appointed the Nominating Committee as follows:

George F. Swain, of Class I

Irving W. Bailey, of Class II

Jeremiah D. M. Ford, of Class III

On recommmendation of the Council, the following appropriations were made for the ensuing year:

From the income of the General Fund, $7,910, to be used as follows:

for General and Meeting expenses	$ 800.00
for Library expenses	1,800.00
for Books, Periodicals, and Binding	1,200.00
for House expenses	3,235.00
for Treasurer's expenses	775.00
at the disposition of the President	100.00
	$7,910.00

From the income of the Publication Fund, $2,967.97, to be used for publication.

From the income of the Rumford Fund, $3,887.87, to be used as follows:

for Research	$1,000.00
for Books, Periodicals, and Binding	200.00
for Publication	600.00
for use at the discretion of the Committee	2,087.87
	$3,887.87

From the income of the C. M. Warren Fund, $1,105.32, to be used at the discretion of the Committee.

The President announced the death of four Fellows:—Brooks Adams (Class III, Section 3), Frederic Dodge (Class III, Section 1), Ira Remsen (Class I, Section 3), and Charles Doolittle Walcott (Class II, Section 1); and of one Foreign Honorary Member, Georg Brandes (Class III, Section 4).

The following communication was presented:

Mr. J. D. M. Ford: "Hispanic America and its Literature."

The Meeting was dissolved at 9.20 P. M.

One thousand one hundred and fifty-fifth meeting.

MARCH 23, 1927.—OPEN MEETING.

An Open Meeting was held at the House of the Academy from four to six o'clock.

The PRESIDENT in the Chair.

There were present about one hundred and seventy-five Fellows, Associates and guests, including ladies.

Mr. George H. Parker, Professor of Zoölogy, Harvard University, spoke on "The Evolution of Mind."

Tea was served at five o'clock in the Reading Room on the third floor.

One thousand one hundred and fifty-sixth meeting.

APRIL 13, 1927.—STATED MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present thirty-two Fellows and Associates and seven guests.

The Records of the meeting of March 9 were read and approved.

The Corresponding Secretary reported the receipt of a biographical memoir of Desmond FitzGerald, by G. F. Swain.

The President announced that Prof. B. L. Robinson had been appointed to the Nominating Committee in place of Prof. I. W. Bailey, who was unable to serve.

The President announced the death of two Fellows:—William Healey Dall (Class II, Section 3), and Charles Sprague Sargent (Class II, Section 2).

The following communication was presented:

Dr. William T. Bovie: "The Mechanisms of Living Protoplasm," with lantern illustrations.

The Meeting was dissolved at 9.10 P. M.

One thousand one hundred and fifty-seventh meeting.

MAY 11, 1927.—ANNUAL MEETING.

The Academy met at its House at 8.15 P. M.

The PRESIDENT in the Chair.

There were present forty-nine Fellows and Associates and seven guests.

The Records of the Meeting of April 13 were read and approved.

The Corresponding Secretary reported the receipt of a biographical notice of Charles Vancouver Piper, by A. S. Hitchcock.

The Corresponding Secretary announced that the Council had voted to postpone the stated meeting of October 12, which falls this year on a legal holiday, to the following Wednesday, October 19.

The President announced the death of Erwin Frink Smith, Fellow in Class II, Section 2.

The following report of the Council was presented:

Report of the Council.

Since the last report of the Council there have been reported the deaths of nineteen Fellows:—Brooks Adams, Simeon Eben Baldwin, William Sturgis Bigelow, William Healey Dall, Frederic Dodge, Charles William Eliot, Paul Revere Frothingham, Desmond Fitz-Gerald, James Furman Kemp, George Richard Lyman, Forris Jewett Moore, Charles Vancouver Piper, Ira Remsen, James Ford Rhodes, Charles Sprague Sargent, Erwin Frink Smith, William Jewett Tucker, Addison Emery Verrill, Charles Doolittle Walcott; and of one Foreign Honorary Member:—Georg Brandes.

Eight Fellows and two Associates were elected by the Council and announced to the Academy in May 1926.

The roll now includes 557 Fellows, 59 Foreign Honorary Members, and sixteen Associates (not including those elected in May 1927).

The annual report of the Treasurer, Ingersoll Bowditch, was read, of which the following is an abstract.

General Fund.

Receipts.

Income on hand April 1, 1926		$ 1,197.92
From Investments	$2,590.75	
" Assessments	3,280.00	
" Admissions	60.00	
" Interest on deposits	130.70	
" Fund for Current Expenses	1,508.92	7,570.37
		$ 8,768.29

Expenditures.

Expenses of Library	$1,867.30	
Treasurer's Expenses	989.92	
Books and Binding	1,406.78	
General Expenses	834.93	
House Expenses	3,099.89	
President's Expenses	41.75	$ 8,240.57
Transferred to Publication Funds	$ 250.00	
Income transferred to Principal	277.72	527.72
		$ 8,768.29

Rumford Fund.

Receipts.

Income on hand April 1, 1926		$10,643.91
From Investments	$4,145.71	
" T. W. Richards, unexpended grants returned	393.70	4,539.41
		$15,183.32

Expenditures.

Purchase and Binding of Books	$ 194.74	
Research.	843.85	
Sundries.	.69	$ 1,039.28
Mass. Hosp. Life Ins. Co. bonus.	$ 41.20	
Income transferred to Principal	184.38	225.58
		$ 1,264.86

C. M. Warren Fund.

Receipts.

Income on hand April 1, 1926		$ 458.29
From Investments	$1,155.51	
" Henry Fay, unexpended grant, returned.	75.00	1,230.51
		$ 1,688.80

Expenditures.

Research.	$1,170.00	
Vault Rent, part	3.00	$ 1,173.00
Income transferred to Principal		55.48
		$ 1,228.48

Publication Fund.

Receipts.

Income on hand April 1, 1926		$ 3,051.54
From Income Appleton Fund	$ 585.50	
" " Centennial Fund	2,469.87	
" Authors' Reprints	575.95	
" Sale of Publications	804.70	
" General Fund Income	250.00	4,686.02
		$ 7,737.56

Expenditures.

Publications	$5,024.35	
Vault Rent, part	10.00	$ 5,034.35
Income transferred to Principal		147.61
		$ 5,181.96

Francis Amory Fund.

Receipts.

From Investments	$ 1,986.00

Expenditures.

Publishing Statement	$ 82.00
Income transferred to Principal	1,904.00
	$1,986.00

The following reports were also presented:

Report of the Library Committee.

During the year 188 volumes and 35 unbound numbers of periodicals have been borrowed by 16 Fellows and 14 libraries, and many more have been consulted at the Academy. All books taken out have been returned or satisfactorily accounted for.

The number of books on the shelves at the time of the last report was 40,479. During the year 405 volumes were added, making the number now 40,884. This includes 76 purchased from the General

Fund, 30 from the Rumford Fund, and 299 received by gift or exchange. The number of pamphlets added was 120.

The expenses charged to the Library during the financial year ending April 1, 1927, are:

Salaries	$1,800.00
Binding:	
General Fund	577.60
Rumford Fund	37.85
Purchase of Books and Periodicals:	
General Fund	834.18
Rumford Fund	156.89
Miscellaneous	67.30
Total	$3,473.82

H. M. Goodwin, *Librarian.*

May 11, 1927.

Report of the Rumford Committee.

The Committee held three meetings during the year and made the following grants:

January 12, 1927.—Professor J. C. Hubbard, New York University, to aid in an investigation of the difference of the specific heats of gases . . . . . No. 259 $200.00

March 9, 1927.—Professor P. W. Bridgman, Harvard University, to aid in continuing his researches on the thermal properties of matter, especially under high pressure . . . . . No. 261 $500.00

International Tables of Constants; usual annual appropriation $200.00

As the Chairman of the Committee, Professor A. E. Kennelly, has been away this year, Professor Saunders has acted as temporary chairman.

Professor T. W. Richards has returned to the fund a sum of over $390.00 from previous grants not expended.

No recommendations were made this year in regard to the award of the Rumford premium.

Reports of progress have been received from Professor G. S. Forbes and others, in regard to researches aided by the fund.

The year has been marked by a lack of applications for aid. A notice has been sent to "Science" to call the attention of investigators to the opportunity offered by the Fund.

F. A. SAUNDERS, *Acting Chairman.*

May 11, 1927.

REPORT OF THE C. M. WARREN COMMITTEE

The Committee had at its disposal at the beginning of the fiscal year 1926-1927, $1500.92, of which $450.92 was the balance from the previous year. The estimated available income for the year 1927–1928 is $1159.72.

Since the last annual report grants have been made as follows:

May 25, 1926: to Professor C. James, University of New Hampshire, $300, to be used in connection with his investigation of the rare earths.

October 26, 1926: to Professor Ben B. Corson, Middlebury College, Vermont, $200, a renewal of a previous grant to be used in his study of the condensation reactions of certain mesoxalic esters.

January 15, 1927: to Professor Henry Gilman, Iowa State College, $200, to assist in the study of chemiluminescence.

May 4, 1927: to Professor Carl L. A. Schmidt and Mr. David M. Greenberg, University of California, $275, to be expended for the purchase of apparatus needed in the study of the transport numbers of proteins.

Reports of progress have been received from Dr. Ben Corson and Dr. Charles F. H. Allen.

The papers listed below, recently published, describe the results of investigations aided by the Warren Fund. In each case there is an acknowledgment by the author of the assistance received.

The Basis for the Physiological Activity of Certain -Onium Compounds. The Mobilities of the -Onium Ions. I. Sulfonium Ions. By Isaac Bencowitz and R. R. Renshaw.

The Basis for the Physiological Activity of Certain -Onium Compounds. V. The Mobilities of the -Onium Ions. II.

By Isaac Bencowitz and R. R. Renshaw.

The Irreversible Oxidation of Organic Compounds. I. The Oxidation of Aminophenols by Reagents of Definite Potential.

By James B. Conant and Malcolm F. Pratt.

The Irreversible Oxidation of Organic Compounds. II. The Apparent Oxidation Potential of Certain Phenols and Enols.

By James B. Conant and Malcolm F. Pratt.

Some Reactions of Delta Ketonic Nitriles. II.

By Charles F. H. Allen.

JAMES F. NORRIS, *Chairman.*

May 11, 1927.

REPORT OF THE COMMITTEE OF PUBLICATION.

Our printers, The Intelligencer Printing Company, of Lancaster, Pennsylvania, have been very prompt, their work has been commented upon favorably by many of the authors of published papers, and the following general statement of costs seem to show that their prices are reasonable.

Eight papers in the Proceedings aggregating 456 pages cost $2364.00 for 1025 copies of each, which is at the rate of $5.20 per page.

Your committee has considered the question of revision of our list prices of papers and has adopted the following schedule:—

PRICE SCHEDULE FOR NUMBERS OF PROCEEDINGS.

10 pages	$ .35
20 pages	.45
30 pages	.60
40 pages	.75
50 pages	.90
75 pages	1.20
100 pages	1.45
150 pages	2.00
200 pages	2.40
250 pages	2.65

In estimating number of pages full-page plates are counted double. Prices for Memoirs double that of Proceedings.

Respectfully submitted,
WM. S. FRANKLIN, *Chairman.*

May 11, 1927.

REPORT OF THE HOUSE COMMITTEE.

The House Committee has had funds at its disposal amounting to $3,438.63, made up as follows:

Balance from last year	$ 253.63
Appropriation for 1926–27	2,950.00
Received for use of rooms	235.00
	$3,438.63

Of this amount, the sum of $2,537.88 has been spent for the usual routine expenses, janitor, light, power, heat, telephone, etc., which differ but slightly from year to year, and $797.01 has been spent for upkeep, making a total of $3,334.89, and leaving an unexpended balance of $103.74.

The total outlay for the routine expenses was $81.35 more than last year, and for upkeep, $53.34 more. The two largest items in the upkeep expenses are for removing the granite curbs from the sidewalk in front of the building, and for painting the entrance hall, and rooms on the ground floor, the office on the third floor, etc.

Our appropriation for the coming year includes a sum for painting the fourth floor stack room, and some other parts of the building, which work we expect to have done this summer.

Meetings have been held as follows:

The Academy	
Stated meetings	8
Open meeting	1
American Antiquarian Society	1
Archaeological Institute	2
Calhoun School Benefit	1
Chamber Music Club	8

Colonial Society	3
Contemporary Club	1
Boston Geological Society	2
Harvard-Technology Chemical Club	5
Lowthorpe School of Landscape Architecture	1
Mediæval Academy of America	1
New England Botanical Club	9
New England Farm and Garden Association	2
Society for Experimental Biology and Medicine	1
Zeta Phi Fraternity	1
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The Council Chamber has been used for Academy Council and Committee meetings, and also by the Mediæval Academy, the Trustees of the Children's Museum, the Thursday Evening Club, etc.

A detailed list of expenditures follows:

Janitor	$ 961.06
Electricity — Light	166.92
Electricity — Power	69.70
Coal	1,040.75
Care of elevator	69.61
Gas	62.28
Water	26.18
Telephone	101.24
Ash tickets	40.20
Upkeep	750.85
Furnishing and equipment	19.06
Janitor's supplies and sundries	27.10
Total expenditure	$3,334.89

WILLIAM H. LAWRENCE, *Chairman.*

May 11, 1927.

On the recommendation of the Treasurer, it was

Voted, That the Annual Assessment be $10.00.

The annual election resulted in the choice of the following officers and committees:

EDWIN B. WILSON, *President*
ARTHUR E. KENNELLY, *Vice-President for Class I*
GEORGE H. PARKER, *Vice-President for Class II*
GEORGE L. KITTREDGE, *Vice-President for Class III*
ROBERT P. BIGELOW, *Corresponding Secretary*
CHARLES B. GULICK, *Recording Secretary*
INGERSOLL BOWDITCH, *Treasurer*
HARRY M. GOODWIN, *Librarian*
WILLIAM S. FRANKLIN, *Editor*

Councillors for Four Years.

ALBERT SAUVEUR, *of Class I* WILLIAM H. WESTON, JR., *of Class II*
CHANDLER R. POST, *of Class III*

Finance Committee.

THOMAS BARBOUR PAUL J. SACHS FREDERICK P. FISH

Rumford Committee.

ARTHUR E. KENNELLY

ELIHU THOMSON
PERCY W. BRIDGMAN
HARRY M. GOODWIN
CHARLES L. NORTON
HARLOW SHAPLEY
FREDERICK A. SAUNDERS

C. M. Warren Committee.

JAMES F. NORRIS

HENRY P. TALBOT
GREGORY P. BAXTER
FREDERICK G. KEYES
WALTER L. JENNINGS
ARTHUR D. LITTLE
REID HUNT

Publication Committee.

(Editor) WILLIAM S. FRANKLIN, *ex officio Chairman.*
EDWIN C. KEMBLE, *of Class I* HERBERT V. NEAL, *of Class II*
GEORGE F. MOORE, *of Class III*

Library Committee.

(Librarian) HARRY M. GOODWIN, *ex officio Chairman*
RAYMOND C. ARCHIBALD, *of Class I* THOMAS BARBOUR, *of Class II*
WILLIAM C. LANE, *of Class III*

House Committee.

WILLIAM H. LAWRENCE, *Chairman*
ROBERT P. BIGELOW S. BURT WOLBACH

Committee on Meetings.

THE PRESIDENT
THE RECORDING SECRETARY
GEORGE H. PARKER GREGORY P. BAXTER WILLIAM C. GREENE

Auditing Committee.

GEORGE R. AGASSIZ JOHN E. THAYER

The Council reported that the following gentlemen were elected members of the Academy:

Class I, Section 1 (Mathematics and Astronomy):
Ejnar Hertzsprung, of Leyden, as Foreign Honorary Member.
Harlan True Stetson, of Cambridge, as Fellow.
Class I, Section 2 (Physics):
John Clarke Slater, of Cambridge, as Fellow.
Class I, Section 3 (Chemistry):
Peter Debye, of Zurich, as Foreign Honorary Member.
Allan Winter Rowe, of Boston, as Fellow.
Class I, Section 4 (Technology and Engineering):
Philip Drinker, of Brookline, as Fellow.
Gordon Maskew Fair, of Cambridge, as Fellow.
Robert Spurr Weston, of Boston, as Fellow.
Class II, Section 1 (Geology, Mineralogy, and Physics of the Globe):
Donald Hamilton McLaughlin, of Cambridge, as Fellow.
Class II, Section 2 (Botany):
Harvey Monroe Hall, of Berkeley, as Fellow.
Ivan Murray Johnston, of Cambridge, as Fellow.
George James Peirce, of Stanford University, as Fellow.
Richard Wettstein, of Vienna, as Foreign Honorary Member.
Class II, Section 3 (Zoölogy and Physiology):
William John Crozier, of Cambridge, as Fellow.
Willem Einthoven, of Leyden, as Foreign Honorary Member.

Axel Leonard Melander, of New York, as Fellow.
Frederick Haven Pratt, of Dedham, as Fellow.

Class II, Section 4 (Medicine and Surgery):
Kenneth Daniel Blackfan, of Brookline, as Fellow.
Henry Hallett Dale, of London, as Foreign Honorary Member.
James Lawder Gamble, of Brookline, as Fellow.
Percy Rogers Howe, of Boston, as Fellow.
James Howard Means, of Boston, as Fellow.
Friedrich von Müller, of Munich, as Foreign Honorary Member.
Joseph Hersey Pratt, of Boston, as Fellow.
Andrew Watson Sellards, of Brookline, as Fellow.
Joseph Treloar Wearn, of Boston, as Fellow.

Class III, Section 1 (Theology, Philosophy, and Jurisprudence):
Francis Crawford Burkitt, of Cambridge, England, as Foreign Honorary Member.
Joseph Redlich, of Vienna, as Foreign Honorary Member.
George Sarton, of Cambridge, as Fellow.
William Learoyd Sperry, of Cambridge, as Fellow.
Quincy Wright, of Chicago, as Fellow.

Class III, Section 2 (Philology and Archaeology):
Earnest Albert Hooton, of Cambridge, as Fellow.
Alfred Vincent Kidder, of Andover, as Fellow.
Langdon Warner, of Cambridge, as Fellow.

Class III, Section 3 (Political Economy and History):
Robert Pierpont Blake, of Cambridge, as Fellow.
Léon Duguit, of Bordeaux, as Foreign Honorary Member.
William Cameron Forbes, of Milton, as Fellow.
Arthur Norman Holcombe, of Cambridge, as Fellow.
Westel Woodbury Willoughby, of Baltimore, as Fellow.

Class III, Section 4 (Literature and the Fine Arts):
George Whitefield Chadwick, of Boston, as Fellow.
Wallace Goodrich, of Boston, as Fellow.
Charles Hopkinson, of Manchester, as Fellow.
Vincent d'Indy, of Paris, as Foreign Honorary Member.
Victor Laloux, of Paris, as Foreign Honorary Member.
Gilbert Murray, of Oxford, as Foreign Honorary Member.
Henri Rabaud, of Paris, as Foreign Honorary Member.

Edwin Arlington Robinson, of New York, as Fellow.
Edmund C. Tarbell, of Boston, as Fellow.
Associate:—Nathaniel Thayer Kidder, of Milton.

The following communication was presented:
Mr. Herbert E. Ives: "Television," with lantern illustrations.
The Meeting was dissolved at 10.05 P. M.

BIOGRAPHICAL NOTICES.

CHARLES ROBERT CROSS (1848–1921).

Fellow in Class I, Section 2, 1877.

Prof. Cross was born at Troy, New York, on the 29th of March, 1848, being the son of George and Lucy Ann (Brown) Cross. He was greatgrandson of Ralph Cross who served as major in the American Army of the Revolution. When the boy was fourteen years of age the family returned to Newburyport, Mass., which for generations had been the family home. Here, after attending the Putnam Free School for about three years, he was graduated in 1865. He had an inborn taste for the physical and natural sciences. The Massachusetts Institute of Technology having, but shortly before, been established, he was attracted to it, and decided, after discussing the matter with the then President Rogers, to enter the Institute. He prepared himself to enter the Sophomore Class, which he did in 1867, while he was engaged in teaching in the High School at New London, Conn.

No course in Physics had been established at the Institute, so that he took the course in "Science and Literature," obtaining his training in Physics under President Rogers and Professor Edward C. Pickering. At the time of his graduation with the degree B. S. in 1870 he was made instructor in Physics. His class was the third to be graduated from the Institute. His promotion quickly followed; assistant professorship in 1871, followed by full professorship in 1875. Thus only five years after graduation he was raised to the Professor's chair. Prof. Pickering resigned in 1877 to become for the rest of his life the able and renowned Director of the Harvard College Observatory, and Prof. Cross was then made Thayer Professor of Physics, head of the Department of Physics in the Institute. To this was added the duties of the Director of the Rogers Laboratory of Physics in 1885. He became "emeritus" professor in 1917. As the Institute grew, his influence was of great importance to it. He studied each proposition with meticulous care and was relied upon by his associates for sound judgment and fairmindedness.

His relations with the students · .narked by justice, and in case of doubt, by generosity. He w .st conscientious and painstaking in the discharge of his duti .ead of a rapidly increasing department, and one of his mo .able characteristics was his open-mind-

edness in receiving suggestions from other members of his department.

Prof. Cross took great satisfaction in the preparation and delivery of his experimental lectures in Physics. He had collected and developed an extensive equipment and this was made use of most effectively in illustration of the various topics of these lectures. He, without doubt, took a very pardonable pride in making his demonstrations as complete and perfect as possible, sparing no pains to attain this result.

Among the many activities which claimed his attention were studies in telephony, a considerable number of papers on the subject being contributed to scientific proceedings and journals. This work was the natural outcome of his early acquaintance with Bell's pioneer experiments carried out in the old Institute buildings, as were also those of Francis Blake. Prof. Cross was for many of the earlier years the leading scientific expert of the Bell Telephone Company.

Recognized as authority on acoustics, he studied musical pitch and audition phenomena and published papers on these subjects.

Early recognizing the beginnings of a great electrical development in 1880, he turned his attention seriously to the problem of education in this field. This resulted in the inauguration under his care in 1882 of what was the first course in Electrical Engineeering in the country. He remained in charge of the course at the Institute until 1902, when, at Prof. Cross' request, a Department of Electrical Engineering was established separate from the Department of Physics. Similar expansions involved the establishment, with his cooperation, of such courses of instruction at the Institute as Electro-chemistry and Industrial Physics.

In this connection we find him serving at the Columbian Exposition of 1893 at Chicago as Chairman of an important section (B) of the International Electrical Congress held there. Prof. Cross also held a high position as consultant, expert, and as witness in many important patent cases, particularly those requiring rare expert knowledge in electricity and kindred subjects. His testimony would itself fill many volumes. We find him contributing to the literature concerning the "electric arc," a very natural consequence of the work which had occupied him in electric lighting.

He held membership in the following societies, generally of the

grade of Fellow:—The American Association for the Advancement of Science as well as the similar British Association; the American Academy of Arts and Sciences; the Physical Society; the American Institute of Electrical Engineers; the American Astronomical Society, etc.

Of the more general type of society, may be mentioned the Appalachian Mountain Club, his evident interest in its activities being indicated by his having been elected as its President for the year 1880.

Perhaps the most notable and long continued service he rendered, outside of the duties of his professorship in the Massachusetts Institute of Technology before related, was that of Chairman of the Rumford Committee of the American Academy. He devoted himself with characteristic fidelity and punctiliousness to this Committee's work for a period of twenty-five years; from 1897 till his death in 1921.

In personal character he was always the modest gentleman, never self-seeking, almost bashful in his demeanor. Personal association with him could not fail to convince one of his complete sincerity and of his high attainments as a scientific man. One soon learned to value his abilities highly, gifted as he was with a fund of information, that indicated the possession of an excellent memory, with a judicial temper leading to a correct valuation of the facts in any case. His work on the Rumford Committee was characterized by painstaking care, and his presentations to the Academy of recommendations for award of the Rumford Medal, from time to time, were marked by a degree of conscientious consideration of the facts in each case, which showed clearly the study he had devoted in preparation.

Prof. Cross, while primarily a scientist of a high order, was none the less informed upon a wide range of subjects, giving to his conversation an unusual breadth and interest.

He was fond of music and possessed an intimate knowledge of it. In like manner, he was a student of art and literature, acquainted with the great galleries of Europe and the history of the countries he loved to visit.

His taste for natural scenery caused him to make many trips to Switzerland, the Tyrol and the Canadian Rockies, which he enjoyed often with his son, Charles Robert Cross, Jr., who was an enthusiastic mountaineer.

The loss of his wife, and his only son, who in 1915 was accidentally

killed while serving with the American Ambulance Corps in France, were severe blows to him, which he quietly and heroically bore. But those who knew him intimately could see signs of failing health and increasing feebleness of body which at last culminated in his sudden death on November 16, 1921 in his seventy-fourth year. He had continued in his duties as Chairman of the Rumford Committee, preserving to the last the clear mental powers which were so characteristic of him.

ELIHU THOMSON.

WILLIAM HEALEY DALL (1845–1927).

Fellow in Class II, Section 3, 1912.

William Healey Dall was born in Boston, Massachusetts, August 21, 1845, and died at the Garfield Hospital, Washington, D. C., March 27, 1927. His father, the Reverend Charles Henry Appleton Dall, was a missionary to India and his mother, Caroline Healey, a woman of much literary ability, was for many years head of a young ladies' school in Washington.

As a boy Dall attended the Boston Latin School, but his formal education does not seem to have progressed much beyond this point. As a naturalist he was in every sense of the word a self-made man. During his early life in and about his native town he became interested in shells through the possession, we are told, of a copy of Gould's "Invertebrata of Massachusetts." Although at this period his time was much taken up in earning a livelihood, he found opportunity to collect and study local mollusks—an occupation that brought him into personal contact with Dr. Gould and later with Louis Agassiz. His early associations with these two men had a profound influence in shaping his subsequent career.

Like Franklin, Dall as a mere boy was led to leave Boston and seek his fortune in distant places. About the time of the Civil War he removed to Chicago where he continued to work for his livelihood, but at the same time he found opportunity to study in the evenings at the Chicago Academy of Sciences. In his new surroundings he formed an intimate acquaintanceship with William Stimpson and Robert Kennicott.

When the Atlantic submarine telegraphic cable seemed threatened with failure the Western Union International Telegraph Expedition was sent to Alaska with the object of laying out a telegraph line, chiefly overland, from one continent to the other. Dall joined this expedition in 1865 and thus entered into an association with the region which for the remainder of his life was to be one of his prime interests. In 1868, with the success of the Atlantic cable, he returned from the North and in 1870 published "Alaska and Its Resources." Shortly after this he entered the United States Geological and Geodetic Survey, and from 1871 to 1874 he was employed in a scientific survey of the Aleutian Islands and the adjacent regions. In 1884 he was transferred to the United States Geological Survey as palaeontologist, and he served the government in this capacity until 1925. From 1880 until his death he was Honorary Curator of Mollusks in the National Museum at Washington with working headquarters in the buildings of the Smithsonian Institution. From 1893 until his death he held the chair of Invertebrate Palaeontology in the Wagner Institute of Science in Philadelphia. He was also an Honorary Curator of the Bishop Museum, Honolulu, from 1899 until 1915. Dall was the recipient of numerous honorary degrees. He was elected to the National Academy of Sciences in 1897 and to the American Academy of Arts and Sciences in 1912.

Dall was an incessant worker in his chosen fields of science. Even his summer vacations, spent in the latter part of his life on the sides of Mount Monadnock, were not passed without their daily quota of work. How everything that fell to his hands gave up its ample yield is seen in his last published paper on certain small shells dredged off the southeastern coast of the United States. The material studied consisted of about three pints of shelly fragments and other like substances. Dall noticed that this material contained many minute shells. He took it home with him, as he says, put it on his desk and when he had a few leisure moments went over it, a teaspoonful at a time, and picked out the specimens. Later when in quarantine at home on account of illness in the family he arranged and mounted the shells, a work completed in 1898. Various duties then compelled him to give little further attention to this material for some years, until in 1922 he was able to complete the paper just published. From

these three pints of fragments Dall unearthed 337 species of shells, 204 of which were new to science. No one but a born naturalist could have had the ability and patience to complete such a task. That Dall was such has been abundantly proved by his long life of quiet, incessant activity. With him passes one of the last of the older type of American naturalists, the like of which we may never see again.

G. H. PARKER.

WILLEM EINTHOVEN (1860–1927).

Foreign Honorary Member in Class II, Section 3, 1927.

With the death of Willem Einthoven on September 29, 1927, there passed away an illustrious contributor to physics, physiology and practical medicine.

Professor Einthoven was born on May 21, 1860, in Samarang (Java) where his father was a physician. Following his father's interests he became a student of medicine at Utrecht in 1878, but after completing the medical course he turned to physiology and served as assistant to Snelling and to Donders. The leadership of these men stimulated him to researches in physiological optics, chromatic aberration in the eye, and stereoscopic vision. He also investigated the effects of high frequency alternating currents on nerves. His work on the action of bronchial muscles helped to lay the foundation for the view prevalent today that asthma is due to a spasmodic contraction of the bronchial musculature.

Before the beginning of the present century Einthoven had started on the researches which marked his greatest services to science—those concerned with the electrical changes accompanying cardiac contraction. In studying these changes he invented the so-called "string" or "thread" galvanometer. This instrument has proved of value not only in physiology, but also in clinical medicine (for diagnosis of heart disease), in wireless telegraphy, and even in warfare. It was because of the invention and perfecting of this instrument and the demonstration of its multifarious uses in science and practice that he was awarded, in 1924, the Nobel Prize in medicine.

Professor Einthoven was a man of the utmost modesty and simplicity of character. He was generous in his judgements, kindly and

gracious in his relations to others, devoted to his scientific pursuits. His quality as a man of science was altogether admirable.

For further notices, see:

A. V. Hill: Physiological Abstracts, 1927, XII, pp. 527–528; also Thomas Lewis and Leonard Hill: The British Medical Journal, 1927, (October 8), pp. 664–665.

W. B. CANNON.

CHARLES WILLIAM ELIOT (1834–1926).

Fellow in Class I, Section 3, 1857.

Mr. Eliot was elected a member of the Academy November 11, 1857, when he was twenty-three years old. He was at that time teaching mathematics and studying chemistry at Harvard. His nominators were Josiah P. Cooke, Joseph Lovering, Francis Bowen, Asa Gray, Benj. Apthorp Gould, C. T. Jackson, and Eben N. Horsford.

The officers of the Academy were then: *President*, Jacob Bigelow, M. D.; *Vice-President*, Daniel Treadwell; *Corresponding Secretary*, Asa Gray; *Recording Secretary*, Samuel L. Abbot.

Mr. Eliot's formal scientific communications to the Academy, all except the last one being made "with F. H. Storer," were as follows: *On The Amounts of Lead Contained in Some Silver Coins, Proc.*, Vol. 5 (1860–'62). p. 52; *On The Chromate of Chromium and Analogous Chromates. Proc*, Vol. 5, p. 192; *On The Impurities of Commercial Zinc, With Special Reference to the Residue Insoluble in Dilute Acids, to Sulphur, and to Arsenic. Memoirs*, Vol. 8 (1861–'63). p. 57. *Mr. S. P. Ruggles's Dynamometer, Proc.*, Vol. 7 (1865–'66), p. 65.

He was a member of the Council from 1875 to 1877 and from 1881 to 1883, of the Rumford Committee from 1863 to 1864, of the Committee on Publication from 1866 to 1868,

The last meeting of the Academy which he is recorded as attending was held on December 12, 1923. The scientific program at this meeting was the following:

Mr. Richard P. Strong: "A Flagellate Infection of Plants and Its Animal Hosts."

Mr. Emory L. Chaffee: "The Electrical Response of the Retina to Stimulation by Light."

Reference: *Charles W. Eliot, The Man and His Beliefs, with a Biographical Study by William Allen Neilson.* Approved by President Eliot for posthumous publication, 2 volumes, Harpers, 1926.

E. H. HALL.

DESMOND FITZGERALD (1846–1926).

Fellow in Class I, Section 4. 1912.

Desmond FitzGerald was born May 20, 1846, at Nassau, New Providence, Bahama Islands, where his father was an officer in the British Army; and he died at his home in Brookline September 22, 1926. On his mother's side he was a descendant of Roger Williams, and as late as 1923 he owned several lots of land in Providence, part of a tract granted to Roger Williams which had never been out of the family.

In 1848 the family moved to Providence where they lived for many years. His early education was in the public schools of that city. He did not receive a college education, either in arts or in engineering. When a young man he spent a year studying art in France with the expectation of becoming a sculptor. Returning to this country he entered Phillips Academy at Andover, from which he graduated in 1864. Shortly after this, and while still under age, he became Deputy Secretary of State of Rhode Island, and in 1866 was private secretary to General Burnside, then Governor of the State. During this period he entered the engineering office of Cushing and DeWitt in Providence as a student, where he had a good opportunity to become acquainted with engineering methods. In 1867 he went west and worked on various railroads as locating, division, or assistant chief engineer. Returning to Boston in 1871 he soon became Engineer of the Boston & Albany Railroad. In 1872 he entered the employ of the City of Boston as Superintendant of the Western Division of its water works system, where he had charge of practically all of the sources of supply for the city. He soon discovered that there was serious pollution of some of the brooks tributary to Lake Cochituate, and by vigorous action he secured the elimination of the pollution.

He was one of the first to study the subject of color of waters, and this study led to the systematic draining of swampy areas on the

water sheds tributary to the Boston supplies and the stripping of top soil and humus from reservoir sites. While with the Boston Water Works he established the first, and for many years the only, biological laboratory in this country operated in connection with a water works system. He made other studies and investigations in hydraulic engineering in connection with rainfall, run-off and evaporation, and twice received the Norman Medal of the American Society of Civil Engineers.

When the Boston Water Works were taken over by the state, Mr. FitzGerald was appointed Engineer of the Sudbury Department. He resigned from this position in 1902, having been connected with the Boston Water Works since 1873. His recognized engineering ability led to his employment in other important engineering works as consulting engineer, including the Chicago Drainage Canal, the water supply of Washington, San Francisco, Manila, and many other cities and towns.

Mr. FitzGerald was much more than a technical engineer. He had many points of contact with his fellow men outside of the details of his profession, and was a public-spirited citizen. He served for several years as Chairman of the Massachusetts Topographical Survey Commission and was a member of the Metropolitan Improvement Commission, for which he made a study and report upon foreign harbors.

In his home town of Brookline he was for many years Chairman of the Park Commission, President of the Civic Society, Trustee of the Public Library, and Trustee of the Walnut Hills Cemetery.

He was a lover and patron of art and collected at his home in Brookline a large gallery of paintings, including many by Dodge MacKnight and other modern artists. He was one of the first in this country to appreciate the work of Claude Monet and others of the same school. To accomodate his paintings he built an art gallery adjoining his residence, to which the public was at times admitted. He had much ability as an artist and would undoubtedly have made a success in that line of work.

Mr. FitzGerald was one of the Trustees of the Boston Museum of Fine Arts, a member of the Corporation of the Massachusetts Institute of Technology, and fellow or member of the American Academy of

Arts and Sciences, the Royal Meteorological Society of England, the New England Meteorological Society, the Society of Colonial Wars, the Massachusetts Society of Sons of the American Revolution, the New England Historical Genealogical Society, and the Appalachian Mountain Club. This list indicates his wide interests outside of the details of his profession. He was a Past-President of the American Society of Civil Engineers and of the New England Water Works Association, and was an honorary member of the American Water Works Association, the American Society of Civil Engineers and of the Boston Society of Civil Engineers, and a member of the American Institute of Consulting Engineers. He was also a member of the Union, St. Botolph, Boston Art, and Engineers' Clubs, and of the Country Club of Brookline.

As President, honorary member, and twice Norman medallist of the American Society of Civil Engineers, his position was unique. He was a great engineer. But as a friend he was even greater. He was thoroughly human and had hosts of friends, in the hearts of whom his passing will leave a permanent void.

Mr. FitzGerald was married in 1870 to Elizabeth E. C. Salisbury, and is survived by two daughters and two sons.

G. F. Swain.

SIR JOSEPH DALTON HOOKER (1817–1911)

Foreign Honorary Member in Class II, Section 1, 1866.

The life of Sir Joseph Hooker must always rank as one of the most remarkable in the history of science. This is true alike of its quantitative and qualitative aspects. The length of his productive scientific career, with publication extending over more than seventy-four years, can scarcely have been exceeded by any other investigator of like ability. The amount of his personal output was enormous. The extent of his editorial work covered many volumes of scientific serials, all of high excellence and great reference value. His explorations, comprehending the most widely separated parts of the antarctic regions, the Himalayan Mountains, Syria, Morocco, the Rocky Mountains and the Sierras, were of almost unexampled extent and variety. His administrative work, both in the importance of the

offices held and in the length and effectiveness of his service, is impressive. He had unusual ability both for detailed observation and theoretical interpretation. His artistic gifts were considerable and his memory marvelous. His fine devotion to pure science was remarkably combined with enthusiasm for its applied aspects. He was generous of his time and had a kindly and solicitous interest in the work of scientific colleagues. He had an exceptional capacity for enduring friendship and was a worthy member of that unique and intimate group of illustrious British scientists which included Darwin, Lyell, Bentham and Huxley.

Joseph Dalton Hooker was born June 30, 1817, at Halesworth, Suffolk, being the second son of William Jackson Hooker and his wife Maria Sarah, eldest daughter of Dawson Turner. During Joseph's childhood and youth his father was professor of botany at the University of Glasgow and was already exhibiting the talents destined to make him, as director of the Royal Gardens at Kew, one of the foremost botanists of his time. His son therefore grew up in the atmosphere of scientific thought, of investigation, of systematic classification, and of stimulus toward exploration.

He studied at the University of Glasgow and there took the degree of M. D. in 1839, receiving the same year the diploma of the College of Surgeons at Edinburgh and also appointment as Assistant-Surgeon of H. M. S. *Erebus*, the larger of two stout sailing vessels then starting on an extended voyage of antarctic exploration under command of Captain (later Sir) James Clark Ross.

This expedition lasted three years, visiting Kerguelen Island, Australia, Tasmania, New Zealand, Hermite Island (near Tierra del Fuego) and the Falkland Islands. Three times it penetrated several hundred miles of pack ice and reached the lofty antarctic ice barrier. There it discovered and named Victoria Land with its gigantic volcanoes Erebus and Terror, and attained a position four degrees south of previous exploration—a record for "furthest south" retained for more than half a century.

Hooker, though officially a surgeon, was permitted, indeed most kindly encouraged by Ross, to assume the duties of naturalist. He managed the dredging and spent long hours in the microscopic study and the drawing of the marine life, both vegetable and animal, his

microscope being lashed to the table in his cramped quarters. Whenever land was touched he was diligent in collecting plants, both phanerogams and cryptogams.

On his return to England Hooker joined his father, who was already established as director of the Royal Botanic Gardens at Kew. He was granted for some years a continuation of his naval salary to enable him to elaborate and publish the results of his explorations. This aid was meager and woefully inadequate to the magnitude of the task, yet with incidental assistance from other sources he was ultimately able to complete and publish between 1844 and 1860 three monumental works, each in two large quarto volumes copiously and very beautifully illustrated, namely the *Flora Antarctica*, the *Flora Novae-Zelandiae*, and the *Flora Tasmaniae*, the last two, besides their wealth of critical descriptive and classificatory matter, including prefatory phytogeographic essays of insight and clarity far in advance of their period.

Long before this task was completed, Hooker, encouraged by Humboldt, engaged in an exploring enterprise of a very different nature, being sent in the interests of British science, particularly of the Kew Gardens, to collect plants in north-eastern India. Here he spent three years under the auspices of the British Woods and Forests Department. During the first two years he traveled chiefly in Sikkim and eastern Nepal, penetrating to the boundary of Tibet. He received much aid from the British officials resident or stationed in northern India and made very extensive collections of plants, seeds, fruits and vegetable products. He also skillfully prepared detailed maps, and these, together with his topographical records, proved of importance to the British in their subsequent occupation of the territories thus surveyed. At the close of the second year, he was joined by Dr. Thomas Thomson, with whose aid work was continued during the third year, chiefly in the Khasia Hills.

Hooker returned to England in 1851 and, though not yet appointed to an adequately salaried position, immediately engaged in several pieces of scientific work, each of them of difficulty and magnitude. His *Enumeration of the Plants of the Galapagos Islands*, a paper based chiefly upon the plants of Macrae and of Darwin, had been prepared before his Indian Journey but published during his absence. Similar-

ly his sumptuously illustrated folio on the *Rhododendrons of Sikkim-Himalaya*, written while he was in India, had already appeared under the editorship of his father. In 1854 he brought out in two octavo volumes his *Himalayan Journals*, which as a work of travel has been compared both favorable and unfavorably with Darwin's classic *Voyage of the Beagle* and which, if less continuous in its interest, was better illustrated and similarly indicative of alert observation faithfully recorded.

With his friend and fellow traveller Thomson, Hooker began his first *Flora Indica* of which but one volume was published (in 1855). He worked, as opportunity permitted, on the antarctic floras, of which the New Zealand portion was published in 1853–55 and the Tasmanian not until 1860.

In 1855 he was appointed Assistant-Director of the Royal Gardens and from that time shared officially in his father's administrative work in much of which he had previously given voluntary aid. In collaboration with Thwaites be brought out (1858–64) an *Enumeratio plantarum Zeylaniae*. He worked over the arctic plants brought back by the expeditions sent out in search of Sir John Franklin, and in 1862 published his *Outlines of distribution of Arctic plants*, a work of note in its time but of less enduring excellence than his other major contributions to science. From inadequate material he was misled into drawing an unduly sharp line between the flora of Greenland and that of adjacent arctic America, a distinction which subsequent exploration has done much to efface. In 1864 he brought out a very useful Hand-book of the New Zealand Flora.

It was in this period of his assistant-directorship that in collaboration with the great master of descriptive botany, George Bentham, he began what was probably his most valuable contribution to science, the *Genera Plantarum* (1862–83). This work in three volumes, together amounting to some 3500 pages, presented in scholarly Latin rather full diagnoses of all the then known genera of the flowering plants and—what had never been previously accomplished—provided keys for their identification. The magnitude of this task can scarcely be overstated. That it should have been done at all is a matter for wonder, that it should have been accomplished with unity of plan and high excellence of execution commands unstinted admira-

tion. Though the work was coöperative throughout and no distinction of authorship appears, it is known that about three-fourths of the subject matter was elaborated by Bentham, who, though engaged in several other botanical enterprises, was able through independent means to avoid the interruptions of teaching, lecturing, curatorial or administrative duties.

In the late fifties and early sixties biological thought and philosophic speculation were centered upon the evolutionary theory. Lyell's compelling proof of the continuity of geologic history, followed by the biological work of Darwin and of Wallace, introduced controversies of unprecedented vigor and animation. Hooker's part in this new development of science was much less varied and ingenious than Darwin's, much less eloquent than Huxley's, yet it had great importance. As an intimate friend and lifelong correspondent he was not only an early confident of Darwin's ideas but had no small part in directing and confirming his views on the botanical side of biology. After examining Hooker's *Antarctic Flora*, Darwin tells him of having "extracted more facts and views from you than from any other person," and later "I consider all the assistance which you have given me is more than I have received from anyone else."

On the death of Sir William Hooker in 1865 his son was made Director of the Royal Botanic Gardens. This position he held for twenty years and its official routine greatly interrupted and doubtless much lessened his personal research. However, the duties of the post were admirably performed and the great establishment under his care was notably developed on the foundations wisely and securely laid by his father. As to the plantations, the museum, the upbuilding of the herbarium and library, as in the guidance of the scientific work, external relations and colonial affiliations his administration seems to have proceeded with admirable judgment and great smoothness. He had the firmness and fairness, the decision and dignity to make him a respected leader. While he cannot be said to have established a school or personal following in the manner of some continental botanists, he drew about him men of distinguished ability —Bentham, Oliver, Clarke, Baker, Dyer and Hemsley, to mention but a few. They were of widely different talents and wonderfully supplemented one another's capacities.

In the years 1870–72 Hooker met with distressing opposition from Ayrton, a radical and overbearing politician unfortunately admitted to one of Gladstone's governments. At one time it seemed possible that the Kew Gardens might suffer severely from his malevolence, but British science nobly rallied to Hooker's defense. His opponent was completely discredited and the incidents of this trying period increased Hooker's influence and tended to strengthen governmental support of the Garden.

In assuming the duties of director, Hooker fell heir to the editorial guidance of the periodicals, which form a significant part of the scientific output of the establishment, namely the *Icones Plantarum* and the *Botanical Magazine*. Of these he conducted the former through ten volumes and the latter (with assistance of Hemsley) through no less than forty volumes, in both series with a minimum of change in their established forms. The management of these beautifully illustrated serials alone must have occupied a significant fraction of his time and energy.

Hooker was not notable as a teacher, nor did he take any great part in the popularizing of his science. It is true, before his journey to India, he helped out the then invalided Graham by giving the botanical lectures at the University of Edinburgh, but the work was distasteful to him. Much later he drew up for the Macmillan Company a *Primer of Botany* that passed through several editions and met in its time with a fair degree of success though a slightly formal and wooden presentation of its subject. Far more generally useful was his *Students' Flora of the British Islands*. This first appeared in 1870 and has become endeared to many British botanists as a convenient and not too difficult introduction to their home flora.

In 1871, in company with John Ball and George Maw, he made a journey to Morocco and explored the Atlas Mountains. Soon thereafter he took up again the gigantic task of a *Flora of British India* and with some important collaboration, especially in the palms (by Beccari) and grasses (by Stapf and Gamble) brought it to successful completion in seven octavo volumes (1872–97) of 6000 pages and including about 16,000 species.

In 1877 Hooker made his only journey to North America. In the company of Dr. and Mrs. Asa Gray and of Gen. and Mrs. Richard

Strachey he joined for some weeks the survey of the central Rocky Mountains which was being conducted by Hayden. Hooker then extended his journey to the Sierras and other portions of California in company with the Grays. He was greatly interested in the geographic relations of the continental American floras, but at no time in his life made any notable contributions to their floristic elaboration if we except his treatment of the not very numerous *Rosaceae* for the *Flora Brasiliensis*. Hooker's relations with Gray were those of high mutual regard and lifelong affection. Their correspondence extended over a very long period and has happily been in great part published.

In 1885 Hooker retired from the directorship of the Royal Gardens and had the satisfaction to see his son-in-law, Prof. (later Sir) William Thiselton-Dyer appointed his successor. On his retirement Hooker purchased a plot of land and residence in Sunningdale (about an hour distant from Kew), which he named "The Camp," the spot having, according to tradition, once been occupied by troops after the battle of Culloden. The ground was sufficiently diversified for attractive planting and the house, adequate in size, was soon rendered homelike and charming. Here Hooker, relieved of administrative cares, passed the remaining twenty-six years of his life. Though at the time of his retirement he had reached an age at which most men would have relinquished their life work, he not only continued many of his tasks but even took on others of magnitude.

Darwin had left a legacy to be used in the preparation of a bibliographic list of the species of flowering plants. This, the "*Index Kewensis*" Hooker, as senior editor and guiding spirit, directed to its completion (1893–95) though the actual compilation was accomplished under the care of Dr. B. Daydon Jackson. The work is one of supreme importance to botanical science.

In 1895 Hooker published in the Annals of the Botanical Garden of Calcutta *A Century of Indian Orchids* with 101 elaborate plates. In 1896 as editor he brought out the *Journal of Sir Joseph Banks during Capt. Cook's first voyage*. In 1898 he finished and published the *Handbook of the Flora of Ceylon* which the death of Trimen had left uncompleted. The closing years of his life were spent in a critical study of the difficult genus *Impatiens*, a group whose classification requires the most delicate floral dissection.

Hooker's influence upon the applied sciences, though mostly indirect, was of much value. There can be no doubt that his encouragement and expert advice were important, if not decisive, factors in the success of several enterprises of much economic significance, such as the cultivation of tea, quinine and rubber in India and of superior fruits in the British colonies of tropical America. His preëminence in the classification of the flowering plants obscures the fact that he worked with success in other fields. In fact he began his botanical activities with a bent toward the cryptogams and it was to them that his earliest publications related. In his studies of the anomalous *Welwitschia* he plunged rather deeply into anatomical investigation. He worked effectively on the fossil plants of several formations. Even in his phanerogamic researches his guiding interest was almost always geographic as well as classificatory.

Hooker's family life was one of great happiness. He was a devoted son and retained through life a touching admiration of his father's talents. He married in 1851 Frances Harriet, the daughter of Prof. J. S. Henslow. It is to her that science owes the admirable English translation of La Maout and Decaisne's *General System of Botany*. She died in 1874 and Sir Joseph in 1876 married Hyacinth, daughter of the Rev. W. Symonds and widow of Sir William Jardine. With the exception of an increasing deafness Hooker retained his faculties to the end of his long life. He died at Windlesham, December 10, 1911, peacefully in his sleep.

Hooker enjoyed many warm friendships and was wonderfully diligent and faithful as a correspondent. His letters, fortunately assembled by Lady Hooker and published with admirable running explanations and comment by Leonard Huxley, give a continuous picture of his travels, his interests, his tastes, and his views. Taken in combination with the letters of his intimate friends Darwin, Huxley, and Gray, they form a fascinating history of a dramatic epoch in the progress of natural science.

Of the many biographical accounts of Hooker, the following are probably the best of those readily accessible.

Sir Joseph Dalton Hooker. Kew Bulletin, 1912, pp. 1–34, with portrait and bibliography.

Sir Joseph Dalton Hooker. By G. S. Boulger, Journ. Bot. vol. 50, pp. 1–9, 33–43. 1912.

SIR JOSEPH DALTON HOOKER. By Lieut. Col. D. Prain. Smithsonian Ann. Rep. 1911, pp. 659–671, with portrait. 1912.

LIFE AND LETTERS OF SIR JOSEPH DALTON HOOKER. By Leonard Huxley. 2 vols. 8vo., illustrated. London. John Murray. 1918.

A GREAT NATURALIST—SIR JOSEPH HOOKER. By Sir E. Ray Lankester. Ann. Rep. Smithsonian Inst. 1918, pp. 585–601.

All these excellent accounts of Hooker's life have been freely consulted in assembling material for the present sketch. To Sir David Prain, a subsequent director of the Royal Gardens at Kew, the writer is more specially indebted for friendly criticism of preliminary manuscript and for very helpful suggestions.

Hooker got great pleasure out of the fine arts. Music in its simpler forms appealed to him. He had himself inherited artistic gifts beyond the ordinary and was a skillful draftsman. In later life he took great and discriminating interest in collecting the Wedgwood plaques and medallions. Like most scholars he was frankly bored by large or formal social functions, but in a quiet way he was of a cordial and social disposition, being very hospitable. For many years he regularly attended the self-styled "x Club," a group of nine distinguished scientists who formed the habit of dining together before the meetings of the Royal Society.

He took seriously his obligations to scientific societies and in length and influence of his associations with them must have had few if any equals. Thus he was a Fellow of the Linnean Society sixty-nine years and its vice-president fifteen years. Of the Royal Society he was a Fellow for sixty-four years, its Vice-President for six years and its President (Great Britain's highest scientific position) five years. Of our own Academy he was Foreign Honorary Member for forty-five years.

During more than seventy years he received degrees, appointments, medals, and other honors exceeding in number and distinction those of any other botanist. In the early seventies several efforts were made to secure knighthood for him. These he steadfastly opposed but in 1878 he was given a K. C. S. I. and on his 80th birthday, the Queen bestowed upon him the rare G. C. S. I. In 1907, at his 90th birthday, by direction of the King he received the insignia of the Order of Merit. Of foreign decorations, being in governmental

service, he declined some of great distinction, but after retirement received several, including the Royal Prussian Order "Pour le Mérite" On the occasion of the Linnean Bicentenary at Upsala a gold medal was given to him. After his death he was chosen by the Japanese as "one of the twenty-nine Heroes of the World that Modern Time has produced."

B. L. Robinson.

CHARLES FRANCIS JENNEY (1860–1923).

Fellow in Class III, Section 1, 1921.

Charles Francis Jenney was born in Middleborough on September 16, 1860. Having always lived in this Commonwealth, he died in Boston on November 29, 1923. He was a descendant of several of the Mayflower pilgrims and a characteristic son of Plymouth Colony, showing forth in his life many of the signal traits of those hardy forebears. Without the training of college, he was a product in prelimimary education of the common school. He was both pupil and teacher in the district school, and a graduate of the high school. His study of law began at the Boston University Law School, where, after receiving the bachelor's degree in law in 1883, he was an instructor and lecturer on Massachusetts practice for many years. He was admitted to the bar in Norfolk County in 1882 and practiced his profession in Hyde Park and later in Boston. He was married in 1886 to Mary E. Bruce, who with two daughters survived him. Three times he was elected to the General Court; in 1886 a member of the House and in 1907 and 1908 a member of the Senate. Aside from holding these offices, he devoted himself entirely to the general practice of the law. Without being narrowed to any speciality, he gave particular attention to real estate law and conveyancing and to equity. He was counsel for the town of Hyde Park and the county of Norfolk. His talents were strong rather than brilliant and did not fit him to excel in forensic encounters. Judicial qualities were early recognized by his frequent appointment as auditor and master. He was a safe counsellor, sagacious both in private affairs and in the public welfare. He exemplified in every relation good common sense, exact learning, and practical knowledge. He was appointed

a judge of the Superior Court in 1909. By temperament as well as by achievements he was admirably fitted for the important work of the bench of the trial court. He was courteous, calm, dignified, fair, impartial. A large portion of wisdom was his. He was full of courage. His industry and persistency were unflagging. Every case that came before him was investigated and analyzed to its final elements. He became learned in the law of every litigation tried before him. His mastery of the underlying principles was such that a small number of his rulings were reversed. Of course, he was no respecter of persons. He had the faculty not only of directing proceedings in his court that, so far as possible, justice was done, but also of making the impression upon all observers that justice was being done according to law. He promoted a feeling of confidence and security among those who had to do with his court. There was generally accorded to him the genuine and profound respect which is founded on patient merit, unadorned by ostentatious display of intellectual brilliancy. He was peculiarly and willingly helpful in his relations with his brother judges. The unusual and steadily increasing excellence of his service on the Superior Court brought to him inevitable promotion to the highest court of the Commonwealth. Tried judicial experience of a high order caused his appointment to the Supreme Judicial Court in 1919, when he was fifty-nine years of age. He was spared for only four years of service on that court, too brief a period to enable him to attain the full development of his powers as an appellate judge. Every opinion written by him is characterized by mastery of the governing principles of law, clarity of statement, amplitude of discussion, soundness of reasoning. His investigation of pertinent authorities was exhaustive. He was thorough in everything that he did. His intellectual vision was unclouded. He was firm of purpose. His insight was penetrating. His clear thought found appropriate expression in plain words and simple sentences, easily understood. His moral fibre was worthy of the best traditions of the Commonwealth.

He was not without interests outside the beaten path of his profession. He had a fund of accurate information on a diversity of subjects. The scholar's love for books and intellectual pursuits was his. He was familiar with much of the best of English literature.

Historical study and investigation were especially attractive to him. Few were more learned in the annals of the Pilgrim colony, and he was intimately acquainted with its geography through all its three centuries. The early settlement of other parts of New England was a favorite field for his research. His monograph entitled "The Fortunate Island of Monhegan" has been generally recognized as the authoritative history as well as a charming narative of the happenings upon that ocean sentinel of the Maine coast. He possessed unusual knowledge touching the relative value of books treating of American history and biography. He was a constant visitor at the book shops in the search for the rare and valuable publications concerning those subjects. He was a lover of birds and wise in ornithology. He was an active member of the Nuttall Ornithological Club and delivered before it interesting papers including accounts of vacation trips to Labrador, Florida and New Mexico, which record accurate and careful observation of their birds. He was also a botanist of more than ordinary skill, familiar with our flowers and ferns. These tastes led him far afield on many a tramp. Active membership in the American Antiquarian Society, the New England Historic Genealogical Society, the American Ornithologists' Union, the American Fern Society, the Appalachian Mountain Club and the Boston Society of Natural History bear witness to the catholicity of his interests. He was an occasional contributor to the proceedings of these organizations.

These, however, were his avocations, the occupation of the leisure hour, the recreation of vacation seasons. His main work was in the judicial department of government. There he made a real contribution to the permanent welfare of the Commonwealth.

ARTHUR P. RUGG.

GEORGE RICHARD LYMAN (1871–1926).

Fellow in Class II, Section 2, 1914.

George R. Lyman was born at Lee Center in northern Illinois on December 1, 1871 and died at Johns Hopkins Hospital, Baltimore, Md., on June 7, 1926, in his fifty-fifth year. Surviving at the time of his death were his wife and daughter, his aged parents and an older brother, a teacher of chemistry, who has since passed beyond.

Thus in the short space of two months were the parents deprived of their only sons. These relatives, unknown to many of Dr. Lyman's scientific friends, may be assured that they have their deepest sympathy though this may not be expressed to them personally.

Like his young friends and small-town acquaintances Lyman, up to eighteen years of age, had the advantages of the local schools of his native county but was not satisfied with this preliminary training. So we find him in the early nineties at Beloit College, comparatively near his birthplace, from which he graduated with the degree of A. B. in 1894. The next two years were spent at Amboy, Ill, where his parents then resided, as Superintendent of the city schools.

No doubt the money earned helped in his further education, since from 1897 to 1901 he held an Austin Teaching Fellowship in Cryptogamic Botany at Harvard University and during the last year was also an instructor in the same subject at Radcliffe College. His spare time during this period was spent in advanced botanical studies at Harvard and, in the later years, in work on his thesis for a doctor's degree which was given him in 1906. Previously the same institution had granted him an A. B. and an A. M. degree.

In 1901 he began his work at Dartmouth College as an instructor in botany. He was made an assistant professor in 1904 and continued as such until 1914. Shortly after, he was appointed pathologist in the U. S. Department of Agriculture at Washington, D. C. In the meantime he had spent nine of his summers on the botanical staff of the Marine Laboratory at Woods Hole, Mass., and a year's leave of absence as lecturer in Cryptogamic Botany at Harvard University, taking Professor Thaxter's classes during the latter's Sabbatical year. His success at Dartmouth is shown by his development of the botanical work from two courses with forty-eight students to eight courses with four hundred and forty students.

There is little doubt that Lyman reached the peak of his botanical prominence during the years he was connected with the U. S. Department of Agriculture, for it was during this period he became generally known to the numerous workers in plant pathology all over the country. His early work at the Department was largely as a pathological inspector of the Federal Horticultural Board but in 1917 he was made Pathologist in Charge of the Plant Disease Survey, a position he re-

tained until he resigned from the department early in 1923. This work brought him in close contact not only with the pathologists in the department but also with those in similar lines of work in the various state experiment stations and agricultural colleges. He built up a strong department largely because of his obliging personality and the fact that he did not try to dominate the state investigators for the glory of the government workers, making the work of mutual benefit and credit for each. This led to his appointment in December, 1918, as Secretary-Treasurer of the American Phytopathological Society, a position he held for four years. It was an honorary position involving much work, especially as at that time we were engaged in the World War. He was also a member of the Society's War Emergency Board, of its Advisory Board, and was a representative of the Society on the National Research Council from 1919 to 1922. In recognition of his efficient work, the Phytopathological Society elected him its President for 1913.

Early in 1923 he was appointed Dean of the College of Agriculture of West Virginia University, a position he held at the time of his death about four years later. His work here, as elsewhere, was very successful. It will be noticed that each of the several positions he held involved a type of work different from any that he had previously undertaken. Yet as teacher, investigator and administrator he measured up to the standards required for successful achievment.

Writes one who was a former student: "I first became acquainted with Doctor Lyman when I was a student at Dartmouth. I took all of his courses in botany and was a student assistant under him during my senior year. He was a very inspiring teacher, presenting his subject matter in such a way that his students could not help but be interested. He also took a personal interest in the students and in that way was very popular with them. When he left teaching work to come to the Department of Agriculture, botany lost a wonderful teacher. At first it seemed too bad that he could not continue along the line in which he was so successful but it proved that he was just as successful in the Department of Agriculture as he was in the class room".

Wrote one of his associates in recommending his advancement in the Department of Agriculture: "Doctor Lyman shows exceptional qualifications for the work of the Department. He is original and

fertile in ideas and very adaptable in dealing with new problems and lines of work. He has a very broad general and botanical training and very exceptional special knowledge of the fungi. He has a pleasing personality, ability to meet and deal with all classes of people and to make public addresses. He writes clearly in good English and is an excellent and very helpful editor of others' manuscripts. He coöperates harmoniously with others, both within and without the Department, and is liked by all with whom he comes in contact. Dr. Lyman has splendid executive ability."

Writes his successor as Dean of Agriculture at the University of West Virginia: "Dr. Lyman came to the University four years ago. The Agricultural College had been without a dean for a year but it was not long, due to his tact, foresight and ability, that he had made a distinct and favorable impression. In his quiet easy way he smoothed out difficulties and developed a spirit of coöperation upon the part of the staff and students. He began to develop forward looking policies which culminated in a plan for an agricultural educational development along very broad lines. He entered into the life of the students more as a friend and advisor than as a Dean of a College. Students were encouraged to frequent his office and no matter how busy he might have been the students' interests received his first attention."

Dr. Lyman was not a prolific scientific writer. His duties as teacher, organizer and executive did not leave much leisure for investigation of scientific problems. The titles of most of his articles show that he wrote mostly for a popular or student class of readers. His most valuable scientific contribution was his doctor's thesis entitled, "Culture Studies on the Polymorphism of the Hymenomycetes." Of his general articles, one has very favorably impressed the writer, both because of its sound reasoning and its general applications—though it was written especially for students at West Virginia. It is entitled, "What Kind of a Man Am I?". Let me quote briefly from it for, while he did not so intend, it reveals his own personality and aim in life.

"There are twenty-seven kinds of men, so one writer informs us. One's first thought after reading this statement is that the number mentioned is far too small. When one thinks of his friends and acquaintances, each with individual peculiarities and differences which

distinguish him from his fellows, one is inclined to believe that there are as many kinds of men and women as there are separate individuals. And this conclusion is correct. Nature makes no duplicates. But we are not so much interested just now in the exact number of kinds of people there are, as we are in the reasons why there should be so many kinds. When we analyze this matter and try to determine just why one individual differs from another, we find that there are just three contributing factors which go to make up a human being, and all the infinite variety of people we see about us is due to the variations in these three factors.

"The first of these factors is *heredity*,—the natural capacity or endowment which is inherited from one's ancestors. The second is *environment*, or the surroundings in which one lives. The third factor is the *response* which a person with a given inheritance makes within his particular environment. Heredity determines what a man *is*, environment is what he *has*, and response is what he *does*. It takes all three of these factors to determine the nature and quality of a man. To use another figure of speeech, heredity is the actor, environment is the stage-setting, and response is what the actor performs upon the stage. The play involves all three.

"If we assume that each of these three factors—heredity, environment and response, occurs in three principal grades which we may roughly call good, medium and poor, we arrive at twenty-seven kinds of men. . . .

"Heredity determines what a man is so far as natural gifts are concerned. Unfortunately our inheritance is fixed in advance for each one of us. . . . He must do the best he can with the inheritance he has received. . . . One can change or modify his environment more or less completely, and he can also change his response to that environment by education, experience and effort, or by neglect of these, and thus materially change the kind of a man that he is.

"There are twenty-seven kinds of men according to the classification given above. The exact niche which one of us occupies in this classification, depends in a very large measure on ourselves. . . . The extent to which we recognize these opportunities and make use of them will in large measure determine the answer to the question "What Kind of a Man Am I?'".

The writer feels he had several things in common with George R. Lyman—both about the same age, born not far apart in northern Illinois, christened George, sons of country editors, selected botany as the same career, studied together at Harvard where we first met, and in life work specialized in plant pathology—but the thing he would value most as a common character, would be the ability to say at the end that his *response* to life was on the same high plane that Lyman answered that final question: "What Kind of a Man Am I ?".

G. P. CLINTON.

FORRIS JEWETT MOORE (1867–1926).

Fellow in Class I, Section 3, 1911.

[This memoir is substantially the same as the record in the Faculty Minutes of the Massachusetts Institute of Technology regarding the life and work of Professor Moore].

Forris Jewett Moore was born at Pittsfield, Massachusetts, June 9, 1867, the son of Forris Jewett and Ellen S. (Wightman) Moore, both of whom were of New England origin. As a lad the younger Moore was studious and an ardent reader, with a power of application of what he read which was beyond his years. He was graduated from the Stevens High School, at Claremont, N. H., with the Class of 1884, and soon after entered Amherst College from which he received the degree of Bachelor of Arts in 1889. During that time he came under the influence of Professor William P. Harris, from whose laboratory so many able and inspiring teachers of chemical science have come to enrich our college faculties. Moore's bent toward Chemistry seems to have dated from his early youth and was definite and unwavering. After graduation he taught in the Amherst laboratories for two years, and then went to Heidelberg for further study, receiving from the University of Heidelberg the degree of Doctor of Philosophy in 1893. In 1892 he married Miss Emma Tod, of Edinburgh, Scotland. Upon his return to the United States he accepted an instructorship in Chemistry at Cornell University for the year 1893–94. In the fall of 1894 he transferred to the Massachusetts Institute of Technology where he was at first associated with the instruction in Analytical Chemistry, later changing to Organic Chemistry, the branch of our

science in which he was mainly interested. For many years he was in charge of all the undergraduate instruction in the Organic Division of the Department of Chemistry. He had of late found it necessary to further husband his strength, and in 1925 he deemed it best to give up active teaching. At the time of his death he was classed as "retired" but he still retained his research assistants, visited his laboratory frequently and took a lively interest in all that concerned the branch of the Department with which he had been so long associated. He died suddenly on November 20, 1926.

Professor Moore published three books: "Outlines of Organic Chemistry," (1910); "Experiments in Organic Chemistry," (1911), and a "History of Chemistry" (1918). Among the more notable of his papers, nearly all of which were published in the Journal of the American Chemical Society, are those on the action of hydrogen peroxide on uric acid, and some of its substitution products, and that upon the constitution of xanthogallol. These papers were generally published in joint-authorship with his students and may be regarded as epitomizing Professor Moore's professional activities.

Exceptionally clear in exposition, and exact in experimentation, he was an unusually successful lecturer, whether to beginners in his subject, or to graduate students. His scholarly habits and wide reading found expression in his "History of Chemistry," which held the general reader as well as the student of chemical science. His researches were exact and executed with notable thought and care. His influence as a teacher in those intangible ways which it is so impossible to express in quantitative terms was great. By his modest, genial, scholarly bearing he won and held the respect and friendship of his students, while, at the same time, he demanded from them a full mead of effort and study. He found great joy in these student friendships, and his pupils have already given expression to their appreciation of his qualities as a sympathetic and an efficient teacher.

To a large circle of friends, Professor Moore's partial retirement from social and professional activities, occasioned by limitations of strength, has for some time brought a sense of loss of a companionship which they had learned to recognize as one of unusual charm. The complete breaking of this bond by death brings added sadness.

H. P. Talbot.

CHARLES VANCOUVER PIPER (1867–1926).

Fellow in Class II, Section 2, 1921.

Professor Charles Vancouver Piper died at Washington, D. C., February 11, 1926, at the age of 58 years. He was born at Vancouver, B. C., (though his father was an American citizen), June 16, 1867, but lived much of his early life in the neighboring state of Washington, from whose State University he was graduated with the degree of B. S. in 1885. In 1892 he received the degree of M. S. from the same institution and later (1900) a similar degree from Harvard University. The honorary degree of D. S. was conferred on him in 1921 by the Kansas Agricultural College. From 1892 until 1903 he was professor of botany and zoology in the Washington Agricultural College (now State College of Washington) and then entered the service of the U. S. Department of Agriculture, first in charge of the Grass Herbarium, Office of the Agrostologist (1903 to 1905) and later (1905 to 1926) in charge of the Office of Forage Crop Investigations.

Professor Piper was much interested in the flora of Washington and the adjoining region. He wrote several manuals of different parts of this area (some in collaboration with Professor R. Kent Beattie) and published in scientific periodicals many new species. He continued this interest even after going to Washington, D. C., and contributed taxonomic articles up to the last year of his life.

After entering the government service, Professor Piper turned his attention to many practical problems concerning agronomic work. To the solution of these problems he brought a fundamental training in botany which aided him greatly. He had a critical knowledge of the botanical relationships of the grasses used as forage plants and for lawns. He had also made numerous contributions to our knowledge of certain genera of legumes that are used as forage plants. He was instrumental in introducing Sudan grass, a kind of sorghum, which has taken its place in American agriculture as a valuable forage plant. Several other grasses and legumes have been introduced or advocated by him, among which may be mentioned Natal, Rhodes, elephant grasses, many sorts of beans, peas, and other legumes. He has been prominent in golf circles because of his investigations on the grasses

suited to golf greens, having developed methods for the vegetative propagation of bent grasses.

In 1904 Professor Piper spent the summer in Alaska collecting especially the grasses. In 1911 he went to the Philippine Islands at the request of the War Department to examine the problem of hay production for army purposes. On this trip he visited other parts of the Orient and also Europe. On a similar mission he visited the Canal Zone in 1923. The following year he went to Europe to study the turf grasses used there on golf courses.

In appearance Professor Piper was tall, well built, and of commanding presence. Until shortly before his death he was physically robust and an indefatigable worker. In character he was kindly and sympathetic. He was positive in his statements and critical in his attitude toward scientific work. He did not hesitate to criticize things as they are but his criticism was helpful because constructive. He was well liked by his associates and held the confidence of his scientific colleagues.

The following biographical notes have been published:

Oakley, R. A. Dr. Charles Vancouver Piper. Bull. Green Sect. U. S. Golf Assn. 6: 54–57. 1926.

Pieters, A. J. Charles Vancouver Piper. Science n. ser. 53: 248. 1926.

Vinall, H. N. Charles Vancouver Piper. Journ. Amer. Soc. Agron. 18: 295–300. 1926.

Beattie, R. Kent. Charles Vancouver Piper and the Flora of the Pacific Northwest. Proc. Biol. Soc. Washington 41: 61–66. 1928.

A. S. Hitchcock.

CHARLES DOOLITTLE WALCOTT, (1850–1927).

Fellow in Class II, Section 1, 1899.

Charles Doolittle Walcott, of Shropshire and New England ancestry, was born on March 31, 1850, at New York Mills, New York, and died of apoplexy at Washington on February 9, 1927. His career was a remarkable one, in that, although entering upon administrative work in his early forties and continuing therein to the end of his life, he nevertheless became the world's greatest authority in

the special field of his self-taught profession of Paleontology that deals with the life and rocks of the Cambrian Period.

Walcott was educated in the public schools of his birthplace and in the Utica Academy, entering the business world at the age of eighteen. His ancestors, according to Professor C. H. Smyth, were rather intimately linked with Hamilton College, and his uncle, the founder of New York Mills, a man of large means who had endowed a chair of Evidences of Christianity in the college, offered to send young Walcott through the institution if he would promise to be a Presbyterian minister. It is interesting to think what a splendid career might have been lost to American geology had Walcott accepted this offer. However, at the age of fourteen he was already collecting fossils from the rich strata in the region of his birth, and in the same year he met the well known paleontologist, Col. E. Jewett, who advised him and helped him to obtain books. In 1871, at Indianapolis, he met the state geologist, Professor E. T. Cox, who further encouraged him to take up the study of Paleontology, already dear to him since his early boyhood.

Returning to New York and working on a farm near the famous geological locality of Trenton Falls, he devoted his spare time to collecting Trenton fossils. In two years he had amassed a large collection with hundreds of trilobites, and Louis Agassiz, seeing these beautiful and highly valuable specimens, purchased the collection for the Museum of Comparative Zoology. This brought Walcott in direct contact with the magnetic Agassiz, who was at the time the only one who could properly evaluate the discovery of the large and handsome *Isotelus platycephalus* with some of the legs preserved. In the December number of the *American Naturalist*, Agassiz says of the specimens: Walcott "was confident they would settle the question of the presence or absence of legs in trilobites. And truly there can be no doubt left upon this point. The basal articulations of eight pairs of legs are distinctly seen on one side of two specimens. Their position is strictly homological with the base of attachment of the limbs of isopods. . . . This discovery shows . . . that trilobites are a synthetic type." Walcott in turn says Agassiz strongly urged "that an attempt should be made to fully discover the ventral surface of the animal and the character of the attached

appendages." Luck was with Walcott, for he found such "in two layers of a fine bluish-gray limestone" near Trenton Falls, and in papers appearing from 1876 to 1881 he announces the discovery of the ventral anatomy of trilobites. He opened a quarry into one of these layers and in the course of two years had 3500 entire trilobites, 2200 of which were in condition to warrant sections being made of them. His cuttings netted 270 sections, showing more or less of the ventral anatomy of *Ceraurus pleurexanthemus*, *Calymene senaria*, *Isotelus platycephalus*, and *Acidaspis trentonensis*. In the meantime he was also on the lookout for growth stages, and in 1879 he gave an account of the metamorphosis of *Triarthrus becki*, the first ontogenetic study of an American trilobite. Finally, in 1881, Agassiz published Walcott's summary paper, "The Trilobite; New and Old Evidence relating to its Organization," wherein the ventral anatomy is fully described and illustrated. These results soon brought to Walcott an international reputation, and ever afterward he was on the hunt among the Cambrian forms for specimens that would show the ventral limbs. It was not, however, until 1894 that he had new evidence of the same sort, and in 1917 and 1919 in "Appendages of Trilobites," and in 1921 in "Notes on Structure of *Neolenus*" he brought up to date all that was known of the ventral anatomy of these crustaceans. These papers show Walcott at his best as a morphologist.

Walcott's career as a paleontologist now lay open before him, and with Agassiz' endorsement he became in 1876 assistant to the leading American paleontologist of the time, James Hall. That summer Hall sent Walcott to Waldron, Indiana, to open a Silurian quarry and was greatly pleased to receive by the end of the season two tons of fossils and slabs. Of more import for Walcott himself, however, was his discovery, two summers later, of "primordial fossils" in place near Saratoga, New York. He had found the same things some years earlier in a drift block near his home and had always been trying to find the source from which they had come; it was this finding, he says, "that gradually led me to take up the Cambrian rocks and faunas as my special field of research." Naturally he wanted to describe these things, one of the dreams of his youth, but Hall was reluctant to have him do so, and, noting also the restless

ambition of the young man and his marked capacity for doing things, recommended him to Clarence King, director of the United States Geological Survey. Finally, however, Hall yielded to Walcott's wish to describe the few Saratoga species and published his results in 1879 as "Descriptions of [six] New Species of Fossils from the Calciferous Formation." This was Walcott's first paper on Cambrian faunas, the subject in which he was to become the world's master mind.

That same year King gave Walcott an appointment as assistant geologist on the Survey, with a salary of $600 per annum, and shortly afterward the whole of the Cambrian of the United States was open to him. First came the lure of the Far West, with its wide expanse of unobscured stratigraphy, and Walcott was soon busy in Utah, Arizona and Nevada. Late in 1882, Powell, desiring to descend from the northern plateau into the depths of the Grand Canyon, constructed "a horse trail from the brink of a lateral canyon on the east face of the Kaibab Plateau, Arizona, down to the more level canyon bed of Nun-ko-weap Valley, 3000 feet below." Walcott later on joined the party, and all descended over the trail to the bottom, where the camp was made. After a few days Powell left the camp, and Walcott told the writer that the Major, departing, said with a twinkle in his eye: "Young man, I am now going to leave you with the men and return to Washington. Soon so much snow will have fallen on the plateau above that you and the packers will not be able to get out of the canyon until Spring; in the meantime I want you to work out the stratigraphic sequence and to collect all the fossils you can. Good luck to you!"

In his paper of 1883, "Pre-Carboniferous Strata in the Grand Canyon of the Colorado," Walcott says: "Seventy-two days of constant work gave some of the information wished." This work was in continuation of that of the summer of 1879, published the following year under the title "The Permian and other Paleozoic Groups of the Kanab Valley, Arizona." In this year Walcott measured a section of 13,300 feet of bedded rocks ranging in time from the lower Tertiary to the pre-Cambrian, and in the winter of 1882–1883 he measured and dated the Paleozoic below the Carboniferous, amounting to 1100 feet, followed by the Grand Canyon

group, 12,000 feet thick, which, on the basis of its few fossils, he thought "may be referred to the Lower Cambrian"; later, however, he transferred it to the Algonkian era of Powell. Beneath all lies the Archean.

The year 1883 brought the brief paper, "The Cambrian System in the United States and Canada," wherein he is unable to fix a definite upper limit for the Cambrian and concludes that the Calciferous fauna is "little more than a closing deposit of the Potsdam." At this time, however, Walcott was still following the wrong fashion of the day in regarding the trilobite *Olenellus* as having descended from *Paradoxides;* accordingly, what we now call Lower Cambrian was then regarded as Middle Cambrian, so that the *Paradoxides* fauna, on the basis of the great studies of Barrande, was thought by all geologists to be basal Cambrian, as it truly is in Bohemia, where the actual Lower Cambrian is lacking.

The discovery that the *Olenellus* fauna lies beneath the zone of *Paradoxides*, instead of above it, was first made by Brögger (1886) and Holm (1887) in Norway and supported by Schmidt (1888) in Esthonia. These results, although not altogether acceptable, led Walcott to look in North America for an equivalent sequence of similar faunas, and his hopes lay in southeastern Newfoundland. There, in the summer of 1888, while on his honeymoon, he proved to his satisfaction that the *Olenellus* fauna "is subjacent to the *Paradoxides* fauna," as he states in his epochal paper of 1889, "Stratigraphic Position of the *Olenellus* Fauna in North America and Europe." Not only this, but now the Grand Canyon series was referred to the Keweenawan group by Walcott, who said both were deposited in pre-Cambrian time. These views have stood the test of time, even though the erratic Jules Marcou characterized them as "leaps into the dark." In this same paper of 1889, Walcott points out that there still remained to be found a fauna that would better link the *Olenellus* fauna to that of the Upper Cambrian—a prophecy that he later on fulfilled by the discovery of the *Bathyuriscus* fauna of the Rocky Mountains.

As we have seen, Walcott joined the United States Geological Survey as assistant geologist in 1879, and in 1888 he was placed in charge of all Paleozoic invertebrate fossils. During the interval

there flowed from his pen a flood of papers on the Cambrian. The chief unsolved problem of his native state was the nature and sequence of the base of the Paleozoic and its relation to the Archeozoic. This was the extremely difficult "Taconic Problem," a question that had discredited its originator, Ebenezer Emmons, and had vexed all geologists who attempted to solve it, among them James Hall, James D. Dana, T. Sterry Hunt, and Jules Marcou. Walcott entered this debated area with confidence, and while it can not be said that he completely unravelled the stratigraphic sequence, and not at all the structural relations, he did lay the foundation, especially by revealing the many local faunas that he found for the first time, and thus made it possible for Arthur Keith to show that most of the structural difficulties of the Taconic Mountains are due to a highly imbricated or overthrusted condition of the region.

While doing the field work on the Taconic area, it was Walcott's wont to call on Hall to talk over his progress, and in this way in 1890 he made the acquaintance of the present writer, who was at that time Hall's private assistant. Partly as a result of this meeting, the latter went to Washington to become Walcott's assistant in the spring of 1893. From this time on until the summer of 1904, the writer saw much of Walcott, and was repeatedly impressed by the ease with which he could lay aside the work of administration and take up his beloved fossils. Often he came singing into my room in the United States National Museum, talked to me at length about his Cambrian work, joked about the doings and personnel of the Survey, and then departed, whistling a tune all out of key.

Walcott succeeded Major Powell as head of the Geological Survey in 1894, and held the office until 1907. He inherited the Survey, therefore, the year following the great cut in the annual appropriation allotted by Congress, which reduced the Survey's money by half, and caused the dropping of over forty university geologists. Here was a great task, but he attacked it heroically and in a few years had regained the lost ground, maintaining, at the same time, the previous high ideals of the Powell Survey. Now the detail of his Cambrian problems had to be assigned to assistants, but each summer Walcott himself was in the field, collecting new stratigraphic and faunal data and regaining strength and vigor to cope with his trying

work of administration. Not only did he again build up the Survey during this time, increasing its appropriations and its printed output, but also developed the Reclamation Service, initiated the Forest Service and the National Advisory Committee on Aeronautics, and helped along the appropriations by Congress for the United States National Museum.

In addition, Walcott was one of a small committee that went to Andrew Carnegie in 1901 and appealed to him to make possible George Washington's wish to have a national university at our capital. As a result of this appeal, there was founded that great institute for research, the Carnegie Institution of Washington, of which Walcott served as Secretary from 1902 to 1905.

Having had such marked success in unearthing the Cambrian faunas that are already far advanced in organic evolution, it was but natural that Walcott should search for their pre-Cambrian ancestors. Richthofen's statement in 1883 that great formations of Proterozoic fossiliferous strata occur in China led him to get the Carnegie Institution to finance an expedition to explore these rocks, headed by Bailey Willis, but in the end the formations proved either to be unfossiliferous or to have only fossils of Cambrian age. In 1899, Walcott brought together all that was known of the Algonkian strata and fossils under the title "Pre-Cambrian Fossiliferous Formations," revealing that, after many years of search, he had found but two places with undoubted pre-Cambrian animal remains, namely, the Grand Canyon series of Arizona and the Belt series of Montana. These remains are rare burrows and tracks of invertebrates, and tubes of annelids, but in many places and at many horizons Walcott had amassed a great mass of information in regard to the lime-secreting algæ known as cryptozöons.

In "Evidences of Primitive Life," 1916, Walcott speculates on the abrupt appearance of the Cambrian faunas and the extraordinary scarcity of known life in the Algonkian. To explain these conditions, he postulates a "Lipalian Interval" of long duration "between the formation of the Algonkian continents and the earliest encroachment of the Lower Cambrian sea." It was during this time that "the open-sea fauna was presumably first developed . . . found its way to the littoral zone and developed in the protected waters along

the ancient epicontinental shelves." Of the actual life of this era, however, we know nothing.

Walcott's next advance was to the secretaryship of the Smithsonian Institution. It has been the history of the Institution that this office alternates between workers in the physical and the natural sciences. Thus, Secretary Langley, an astronomer and physicist, had succeeded Secretary Baird, the zoologist, and as the former was but little familiar with the ways of Congress, Walcott helped him greatly in the matter of getting appropriations for the various bureaus under the wing of the Smithsonian. Upon the death of Langley, it was therefore natural for the Regents to think most favorably of Walcott as his successor, especially since the latter was a naturalist. Accordingly, Walcott was chosen in 1907 to be Secretary, and executive head, of the Smithsonian Institution, which is considered the greatest honor that can come to an American man of science.

The executive duties of the Secretary of the Smithsonian need not necessarily take up all of his time, and so we find Walcott again at work with his vast riches of Cambrian facts and fossils. Now he could widen to the full limit the field of his researches, and almost every summer after his appointment he and his family were in the Rocky Mountains of Canada unearthing the marvellous Cambrian succession. Here the Cambrian is extraordinarily complete in stratal sequence, upward of 12,000 feet thick, and abounding in fossils. In "A Geologist's Paradise," 1911, he says: "Nature has a habit of placing some of her most attractive treasures in places where the average man hesitates to look for them." In these Canadian Rockies there are "four miles or more in thickness of bedded rocks forming the main range"; and here especially one has "a sense of age and infinite power, and we are inspired with awe as we trace to the base the worn-down rocks miles in thickness formed far back in geologic time."

One of the most striking of Walcott's faunal discoveries came at the end of the field season of 1909, when Mrs. Walcott's horse slid in going down the trail and turned up a slab that at once attracted her husband's attention. Here was great treasure—wholly strange Crustacea of Middle Cambrian time—but where in the mountain was the mother rock from which the slab had come? Snow was

even then falling, and the solving of the riddle had to be left to another season, but next year the Walcotts were back again on Mount Wapta, and eventually the slab was traced to a layer of shale—later called the Burgess shale—3000 feet above the town of Field, British Columbia, and 8000 feet above the sea. A quarry operated in this shale from 1910 to 1913 and again in 1917 has brought to light what is probably the most interesting and strangest of all invertebrate assemblages. The many thousands of specimens taken from these diggings include algæ, sponges with spicules, an array of annelids showing the ventral anatomy, brachiopods, and, most numerous of all, phyllocarids and trilobites with appendages and internal structures. Walcott has described 70 genera and 130 species of Burgess forms, but a vast mine of knowledge still lies buried in these most difficult of fossils.

Concerning the morphology, growth stages, and phylogeny of trilobites, Walcott's best paper is the one entitled "*Olenellus* and other Genera of the Mesonacidæ," published in 1910. Here are described 36 species in 10 genera of this most remarkable stock of trilobites.

Of faunal studies, his most comprehensive contribution is "The Fauna of the Lower Cambrian or *Olenellus* Zone," 1890, dealing with 138 species, although a complete working over of what he has assembled at Washington would bring this total to several hundred. The work still remains the standard for this subject.

Walcott's most monumental and most thoroughly wrought out work is, of course, his "Cambrian Brachiopoda," appearing in two quarto volumes in 1912. It describes the forms of the entire world, totalling 535 in number, distributed among 59 genera, and found at 1050 localities; 360 of these forms occur in America. It will always remain the classic work for these organisms, the foundation on which all classifications of the brachiopods must rest.

From Walcott's first paper, appearing in 1875, to the last one, which was published two months after his death, his strictly paleontological and geological titles appear to number over 170, some 110 of which have to do with the Cambrian. His complete bibliography will rise to some hundreds of titles.

His outstanding work as scientist and administrator brought to

Walcott his full meed of honors. Scientific societies gave him five of their most coveted medals: Bigsby and Wollaston of England, Gaudry of France, Thompson and Hayden of America. He was selected by his colleagues to be president of the National Academy of Sciences, holding that high office from 1917 to 1923. He was a foreign associate of the great French Academy. Finally, himself without academic training, he was privileged to wear the scarlet gown of Cambridge, the honorary insignia of such other institutions as St. Andrews, Christiania, Paris, Hamilton, Pittsburgh, Chicago, Johns Hopkins, Pennsylvania, Harvard, and Yale. His passing leaves a conspicuous gap in the rapidly thinning ranks of geologists and paleontologists who built up the edifice of American stratigraphy upon the foundation laid by their pioneer forebears.

CHARLES SCHUCHERT.

ARTHUR GORDON WEBSTER (1863–1923)

Fellow in Class I, Section 2, 1895.

ARTHUR GORDON WEBSTER, Professor of Physics in Clark University, Worcester, was for many years one of the most active, useful and distinguished members of the Academy. He was its Librarian for several years immediately preceding his death. He was one of the most frequent and most effective participants in its scientific discussions, having remarkably wide knowledge, quick perception, and a faculty of luminous exposition touched by humor. His very prominence among the men of science in this country makes unnecessary and undesirable any extended memoir of him here, as much has been or will be written elsewhere concerning him.

He was born in Brookline, Massachusetts, on November 28, 1863, and he died, tragically, in Worcester on May 15, 1923. His ancestry is said to have included, besides the English Websters, "Scotch Gordons, Welsh Davises, and Irish Shannons." The New England history of his family began with the settlement of his ancestor John Webster at Ipswich, Massachusetts, in 1635. One of the descendants of this John Webster was Hannah Webster who, as Hannah Dustin, stands out as an heroic figure in the grim annals of Indian warfare in our colonial times; another, David Webster, great-great grandfather of

our colleague, founded the town of Plymouth in New Hampshire and was a lieutenant colonel of New Hampshire troops in the Revolutionary War.

Webster graduated from Harvard College in 1885 at the head of a class containing several men whose names have since become widely known. After a year of graduate research work in the Jefferson Physical Laboratory he went abroad as holder of a "travelling fellowship," and he remained in Europe four years, studying at various centres of learning, especially at Berlin where he received the degree of Doctor of Philosophy in 1890. In these years also he acquired a remarkable proficiency in the use of foreign languages.

Returning to America, he went at once to Clark University, where he was a docent for two years, becoming head of the Department of Physics at the end of that time, when Doctor A. A. Michelson was called from Clark to the University of Chicago.

He led in the movement which founded the American Physical Society and for many years he was its most animating spirit. While doing a vast amount of work in lecturing and in the direction of experimental research, he wrote notable treatises on Electricity and Magnetism and on Dynamics, books almost unique among American publications in physics for their high intellectual level.

He did more, perhaps, than any other American of his time to raise the general level of scholarship among the physicists of this country.

References to biographical notices or memoirs:

Physical Review, 2nd Series, Vol. 21, No. 6, June, 1923.

Science, Vol. 58, July 20, 1923.

Publications of the Clark University Library, Vol. 7, No. 4, March, 1924. This contains addresses in memory of Webster delivered at Worcester on December 7, 1923, and also a bibliography of his writings.

Biographical Memoirs of the National Academy of Sciences. The writing of the memoir in this case has been assigned to Professor Joseph S. Ames of Johns Hopkins University. It is not yet in print.

E. H. HALL.

American Academy of Arts and Sciences.

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Bradley Moore Davis. . . . . Ann Arbor, Mich.
Edward Murray East. . . . . Jamaica Plain
Rollins Adams Emerson . . . . . Ithaca, N. Y.
Alexander William Evans . . . . . New Haven, Conn.
Merritt Lyndon Fernald. . . . . Cambridge
Harvey Monroe Hall. . . . . Berkeley, Cal.
Robert Almer Harper. . . . . New York, N. Y.
Albert Spear Hitchcock . . . . . Washington, D. C.
John George Jack. . . . . East Walpole
Edward Charles Jeffrey . . . . . Cambridge
Ivan Murray Johnston . . . . . Cambridge
Fred Dayton Lambert . . . . . Tufts College
Jacob Goodale Lipman . . . . . New Brunswick, N. J.
Burton Edward Livingston . . . . . Baltimore Md.

Elmer Drew Merrill . . . . . Berkeley, Cal.
Winthrop John Vanleuven Osterhout . . . . New York, N. Y.
George James Peirce . . . . . Palo Alto, Cal.
Alfred Rehder . . . . . Jamaica Plain
Benjamin Lincoln Robinson . . . . . Cambridge
William Albert Setchell . . . . . Berkeley, Cal.
Arthur Bliss Seymour . . . . . Cambridge
John Donnell Smith . . . . . Baltimore, Md.
Elvin Charles Stakman . . . . . St. Paul, Minn.
William Codman Sturgis . . . . . New York, N. Y.
Roland Thaxter . . . . . Cambridge
William Trelease . . . . . Urbana, Ill.
William Henry Weston, Jr. . . . . Cambridge

CLASS II., SECTION III.—*Zoology and Physiology.*—63.

Nathan Banks . . . . . Cambridge
Thomas Barbour . . . . . Boston
Francis Gano Benedict . . . . . Boston
Henry Bryant Bigelow . . . . . Concord
Robert Payne Bigelow . . . . . Brookline
Edwin Garrigues Boring . . . . . Cambridge
William T. Bovie . . . . . Chicago, Ill.
Edward Allen Boyden . . . . . Chicago, Ill.
John Lewis Bremer . . . . . Boston
Charles Thomas Brues . . . . . Boston
Walter Bradford Cannon . . . . . Cambridge
Thorne Martin Carpenter . . . . . Boston
William Ernest Castle . . . . . Belmont
Charles Value Chapin . . . . . Providence, R. I.
Benjamin Preston Clark . . . . . Boston
Samuel Fessenden Clarke . . . . . Williamstown
Edwin Joseph Cohn . . . . . Cambridge
Edwin Grant Conklin . . . . . Princeton, N. J.
Manton Copeland . . . . . Brunswick, Me.
William John Crozier . . . . . Cambridge
Joseph Augustine Cushman . . . . . Sharon
Charles Benedict Davenport . . . . Cold Spring Harbor, N. Y.

Samuel Randall Detwiler. . . . . New York, N. Y.
Raymond Dodge . . . . . New Haven, Conn.
Gilman Arthur Drew. . . . . Eagle Lake, Fla.
Cecil Kent Drinker . . . . . Boston
Herbert McLean Evans . . . . . Berkeley, Cal.
Alexander Forbes. . . . . Milton
Samuel Henshaw . . . . . Cambridge
Samuel Jackson Holmes . . . . . Berkeley, Cal.
Leland Ossian Howard . . . . . Washington, D. C.
Herbert Spencer Jennings . . . . . Baltimore, Md.
Charles Willison Johnson. . . . . Brookline
Charles Atwood Kofoid . . . . . Berkeley, Cal.
Frederic Thomas Lewis . . . . . Waban
Ralph Stayner Lillie . . . . . Chicago, Ill.
Richard Swann Lull . . . . . New Haven, Conn.
Edward Laurens Mark . . . . . Cambridge
Ernest Gale Martin . . . . . Palo Alto, Cal.
Albert Davis Mead . . . . . Providence R. I.
Axel Leonard Melander . . . . . New York, N. Y.
Gerrit Smith Miller . . . . . Washington, D. C.
Herbert Vincent Neal. . . . . Tufts College
Henry Fairfield Osborn . . . . . New York, N. Y.
George Howard Parker . . . . . Cambridge
William Patten . . . . . Hanover, N. H.
Raymond Pearl . . . . . Baltimore, Md.
John Charles Phillips. . . . . Wenham
Henry Augustus Pilsbry . . . . . Philadelphia, Pa.
Frederick Haven Pratt . . . . . Dedham
Herbert Wilbur Rand. . . . . Cambridge
Arthur Clarence Redfield. . . . . Boston
William Emerson Ritter . . . . . Berkeley, Cal.
Alexander Grant Ruthven . . . . . Ann Arbor, Mich.
Percy Goldthwait Stiles . . . . . Newtonville
John Eliot Thayer. . . . . Lancaster
William Lyman Underwood. . . . . Belmont
John Broadus Watson . . . . . New York, N. Y.
Arthur Wisswald Weysse. . . . . Boston

William Morton Wheeler. . . . . Jamaica Plain
Edmund Beecher Wilson. . . . . New York, N. Y.
Frederick Adams Woods. . . . . New York, N. Y.
Robert Mearns Yerkes . . . . . Washington, D. C.

CLASS II., SECTION IV.—*Medicine and Surgery.*—47.

Nathaniel Allison. . . . . Boston
Kenneth Daniel Blackfan . . . . . Brookline
Charles Macfie Campbell. . . . . Cambridge
Alexis Carrel . . . . . New York, N. Y.
Henry Asbury Christian. . . . . Boston
Stanley Cobb . . . . . Ponkapoag
Rufus Cole. . . . . New York, N. Y.
Harvey Cushing . . . . . Boston
David Linn Edsall . . . . . Cambridge
Simon Flexner. . . . . New York, N. Y.
James Lawder Gamble . . . . . Brookline
Joseph Lincoln Goodale . . . . . Boston
Robert Battey Greenough . . . . . Boston
Ross Granville Harrison . . . . . New Haven, Conn.
Percy Rogers Howe . . . . . Boston
William Henry Howell . . . . . Baltimore, Md.
Reid Hunt. . . . . Boston
Henry Jackson. . . . . Boston
Elliott Proctor Joslin. . . . . Boston
William Williams Keen . . . . . Philadelphia, Pa.
Roger Irving Lee . . . . . Brookline
Frank Burr Mallory . . . . . Brookline
William James Mayo. . . . . Rochester, Minn.
James Howard Means . . . . . Boston
George Richards Minot . . . . . Boston
Robert Bayley Osgood . . . . . Boston
Joseph Hersey Pratt . . . . . Boston
William Lambert Richardson . . . . . Boston
Milton Joseph Rosenau . . . . . Brookline
Andrew Watson Sellards. . . . . Boston
Frederick Cheever Shattuck. . . . . Boston

Theobald Smith . . . . . Princeton, N. J.
Charles Wardell Stiles . . . . . Washington, D. C.
Richard Pearson Strong . . . . . Boston
Edward Wyllys Taylor . . . . . Boston
William Sydney Thayer . . . . . Baltimore, Md.
Ernest Edward Tyzzer . . . . . Wakefield
Frederick Herman Verhoeff . . . . . Boston
Henry Pickering Walcott. . . . . Cambridge
John Warren . . . . . Boston
Joseph Treloar Wearn . . . . . Weston
William Henry Welch. . . . . Baltimore, Md.
Benjamin White . . . . . Boston
Francis Henry Williams . . . . . Boston
Simeon Burt Wolbach . . . . . Boston
Horatio Curtis Wood. . . . . Philadelphia, Pa.
Hans Zinsser . . . . . Boston

Class III.—*Moral and Political Sciences.*—182.

Section 1.—*Theology, Philosophy, and Jurisprudence.*—38.

Joseph Henry Beale . . . . . Cambridge
Charles Henry Brent. . . . . Buffalo, N. Y.
Howard Nicholson Brown . . . . . Framingham Centre
Edmund Burke Delabarre . . . . . Providence, R. I.
Edward Staples Drown . . . . . Cambridge
William Harrison Dunbar . . . . . Cambridge
William Wallace Fenn . . . . . Cambridge
Frederick Perry Fish. . . . . Brookline
George Angier Gordon . . . . . Boston
William Ernest Hocking. . . . . Cambridge
Charles Evans Hughes . . . . . New York, N. Y.
Frederick John Foakes Jackson. . . . . New York, N. Y.
William Lawrence. . . . . Boston
Frederick Lawton. . . . . Boston
William Caleb Loring. . . . . Boston
William McDougall . . . . . Durham, N. C.
Edward Cadwell Moore . . . . . Cambridge
John Bassett Moore . . . . . New York, N. Y.

George Herbert Palmer . . . . . Cambridge
Charles Edwards Park . . . . . Boston
Leighton Parks . . . . . New York, N. Y.
Francis Greenwood Peabody. . . . . Cambridge
George Wharton Pepper. . . . . Philadelphia, Pa.
Roscoe Pound. . . . . Belmont
Elihu Root. . . . . New York, N. Y.
James Hardy Ropes . . . . . Cambridge
Arthur Prentice Rugg. . . . . Worcester
George Sarton. . . . . Cambridge
Austin Wakeman Scott . . . . . Cambridge
Willard Learoyd Sperry . . . . . Cambridge
Moorfield Storey . . . . . Boston
William Howard Taft. . . . . Washington, D. C.
William Cushing Wait . . . . . Medford
Eugene Wambaugh . . . . . Cambridge
Edward Henry Warren . . . . . Boston
Winslow Warren . . . . . Dedham
Samuel Williston . . . . . Belmont
Quincy Wright. . . . . Chicago, Ill.

CLASS III., SECTION II.—*Philology and Archaeology.*—56.

Francis Greenleaf Allinson . . . . . Providence, R. I.
William Rosenzweig Arnold. . . . . Cambridge
Maurice Bloomfield . . . . . Baltimore, Md.
Franz Boas. . . . . New York, N. Y.
Ingersoll Bowditch . . . . . Jamaica Plain
Carl Darling Buck . . . . . Chicago, Ill.
Eugene Watson Burlingame. . . . . New Haven, Conn.
Edward Capps. . . . . Princeton, N. J.
George Henry Chase . . . . . Cambridge
Walter Eugene Clark. . . . . Cambridge
Roland Burrage Dixon . . . . . Cambridge
Franklin Edgerton . . . . . New Haven, Conn.
Jesse Walter Fewkes . . . . . Washington, D. C.
Jeremiah Denis Mathias Ford . . . . . Cambridge
Pliny Earle Goddard. . . . . New York, N. Y.

Charles Hall Grandgent . . . . . Cambridge
Louis Herbert Gray . . . . . New York, N. Y.
William Chase Greene . . . . . Cambridge
Charles Burton Gulick . . . . . Cambridge
Roy Kenneth Hack . . . . . Cincinnati, O.
William Arthur Heidel . . . . . Middletown, Conn.
George Lincoln Hendrickson. . . . . New Haven, Conn.
Bert Hodge Hill . . . . . Athens, Greece
Elijah Clarence Hills. . . . . Berkeley, Cal.
William Henry Holmes . . . . . Washington, D. C.
Earnest Albert Hooton . . . . . Cambridge
Edward Washburn Hopkins. . . . . New Haven, Conn.
William Guild Howard . . . . . Cambridge
Aleš Hrdlička . . . . . Washington, D. C.
Eugene Xavier Louis Henry Hyvernat. . . . Washington, D. C.
Carl Newell Jackson . . . . . Cambridge
James Richard Jewett . . . . . Cambridge
Alfred Vincent Kidder . . . . . Andover
Alfred Louis Kroeber. . . . . Berkeley, Cal.
Kirsopp Lake . . . . . Cambridge
Henry Roseman Lang . . . . . New Haven, Conn.
Charles Rockwell Lanman . . . . . Cambridge
John Livingston Lowes . . . . . Cambridge
David Gordon Lyon . . . . . Cambridge
Clifford Herschel Moore . . . . . Cambridge
George Foot Moore . . . . . Cambridge
Hanns Oertel . . . . . Munich, Germany
Chandler Rathfon Post . . . . . Cambridge
Edward Kennard Rand . . . . . Cambridge
George Andrew Reisner . . . . . Cambridge
Edward Robinson . . . . . New York, N. Y.
Fred Norris Robinson. . . . . Cambridge
Rudolph Schevill . . . . . Berkeley, Cal.
Herbert Weir Smyth . . . . . Cambridge
Herbert Joseph Spinden . . . . . Cambridge
Franklin Bache Stephenson . . . . . Washington, D. C.
Charles Cutler Torrey . . . . . New Haven, Conn.

Alfred Marston Tozzer . . . . . Cambridge
Langdon Warner . . . . . Cambridge
Clark Wissler . . . . . New York, N. Y.
James Haughton Woods . . . . . Cambridge

CLASS III., SECTION III.—*Political Economy and History.*—44.

Wilbur Cortez Abbott . . . . . Cambridge
Charles McLean Andrews . . . . . New Haven, Conn.
Carl Lotus Becker . . . . . Ithaca, N. Y.
Robert Pierpont Blake . . . . . Cambridge
Charles Jesse Bullock . . . . . Cambridge
Thomas Nixon Carver . . . . . Cambridge
Edward Channing . . . . . Cambridge
John Bates Clark . . . . . New York, N. Y.
Richard Henry Dana . . . . . Cambridge
Clive Day . . . . . New Haven, Conn.
Davis Rich Dewey . . . . . Cambridge
Ephraim Emerton . . . . . Cambridge
Henry Walcott Farnam . . . . . New Haven, Conn.
Max Farrand . . . . . San Gabriel, Cal.
William Scott Ferguson . . . . . Cambridge
Irving Fisher . . . . . New Haven, Conn.
William Cameron Forbes . . . . . Milton
Worthington Chauncey Ford . . . . . Cambridge
Edwin Francis Gay . . . . . Cambridge
Frank Johnson Goodnow . . . . . Baltimore, Md.
Evarts Boutell Greene . . . . . New York, N. Y.
Arthur Twining Hadley . . . . . New Haven, Conn.
Albert Bushnell Hart . . . . . Cambridge
Charles Homer Haskins . . . . . Cambridge
Charles Downer Hazen . . . . . New York, N. Y.
Arthur Norman Holcombe . . . . . Cambridge
George La Piana . . . . . Cambridge
Abbot Lawrence Lowell . . . . . Cambridge
William MacDonald . . . . . New York, N. Y.
Charles Howard McIlwain . . . . . Cambridge
Roger Bigelow Merriman . . . . . Cambridge
Samuel Eliot Morison . . . . . Boston

William Bennett Munro . . . . . Boston
Charles Lemuel Nichols . . . . . Worcester
Michael Ivanovich Rostovtzeff . . . . . New Haven, Conn.
William Milligan Sloane . . . . . New York, N. Y.
John Osborne Sumner . . . . . Boston
Frank William Taussig . . . . . Cambridge
Frederick Jackson Turner . . . . . Madison, Wis.
Claude Halstead Van Tyne . . . . . Ann Arbor, Mich.
Westel Woodbury Willoughby . . . . . Baltimore, Md.
George Grafton Wilson . . . . . Cambridge
George Parker Winship . . . . . Charles River
Allyn Abbott Young . . . . . Cambridge

CLASS III., SECTION IV.—*Literature and the Fine Arts.*—44.

Irving Babbitt. . . . . Cambridge
George Pierce Baker . . . . . New Haven, Conn.
Frank Weston Benson . . . . . Salem
Le Baron Russell Briggs . . . . . Bournedale
Charles Allerton Coolidge . . . . . Boston
Frederick Shepherd Converse . . . . . Westwood
Wilberforce Eames . . . . . New York, N. Y.
Edward Waldo Emerson . . . . . Concord
William Emerson . . . . . Cambridge
Arthur Fairbanks . . . . . Hanover, N. H.
Frank Edgar Farley . . . . . Middletown, Conn.
Edward Waldo Forbes . . . . . Cambridge
Kuno Francke. . . . . Cambridge
Daniel Chester French . . . . . New York, N. Y.
Horace Howard Furness . . . . . Philadelphia, Pa.
Wallace Goodrich . . . . . Boston
Robert Grant . . . . . Boston
Morris Gray . . . . . Boston
Chester Noyes Greenough . . . . . Cambridge
Charles Hopkinson . . . . . Manchester
Mark Antony DeWolfe Howe . . . . . Boston
Archer Milton Huntington . . . . . New York, N. Y.
George Lyman Kittredge. . . . . Cambridge
William Coolidge Lane . . . . . Cambridge

John Ellerton Lodge . . . . . Boston
Charles Martin Tornov Loeffler. . . . . Medfield
Charles Donagh Maginnis . . . . . Brookline
Albert Matthews . . . . . Boston
Harold Murdock . . . . . Brookline
William Allan Neilson . . . . . Northampton
William Lyon Phelps. . . . . New Haven, Conn.
Arthur Kingsley Porter . . . . . Cambridge
Herbert Putnam . . . . . Washington, D. C.
Edwin Arlington Robinson . . . . . New York, N. Y.
Denman Waldo Ross. . . . . Cambridge
Paul Joseph Sachs. . . . . Cambridge
Ellery Sedgwick . . . . . Boston
Henry Dwight Sedgwick. . . . . Boston
Richard Clipston Sturgis. . . . . Boston
Edmund C. Tarbell . . . . . Boston
Charles Howard Walker . . . . . Boston
Owen Wister . . . . . Philadelphia, Pa.
George Edward Woodberry . . . . . Beverly
Charles Henry Conrad Wright . . . . . Cambridge

ASSOCIATES.—16.

Charles Francis Adams . . . . . Concord
Francis Noyes Balch . . . . . Jamaica Plain
Charles Foster Batchelder . . . . . Cambridge
William Brooks Cabot . . . . . Boston
John Albert Cousens . . . . . Tufts College
Henry Winchester Cunningham. . . . . Milton
Charles Ernest Fay . . . . . Somerville
Francis Russell Hart . . . . . Boston
William James. . . . . Cambridge
Nathaniel Thayer Kidder . . . . . Milton
Everett Morss. . . . . Boston
Andrew James Peters. . . . . Boston
Anthony John Philpott . . . . . Arlington
Charles Henry Taylor . . . . . Boston
Edwin Sibley Webster . . . . . Brookline
Benjamin Loring Young. . . . . Weston

FOREIGN HONORARY MEMBERS.—67.

(Number limited to seventy-five.)

Class I.—*Mathematical and Physical Sciences.*—22.

Section I.—*Mathematics and Astronomy.*—7.

Arthur Stanley Eddington	Cambridge
Jacques Salomon Hadamard	Paris
Godfrey Harold Hardy	Oxford
Ejnar Hertzsprung	Leyden
Tullio Levi-Civita	Rome
Charles Emile Picard	Paris
Charles Jean de la Vallée Poussin	Louvain

Class I., Section II.—*Physics.*—5.

Albert Einstein	Berlin
Sir Joseph Larmor	Cambridge
Max Planck	Berlin
Sir Ernest Rutherford	Cambridge
Sir Joseph John Thomson	Cambridge

Class I., Section III.—*Chemistry.*—5.

Peter Debye	Zurich
Fritz Haber	Berlin
Henri Louis Le Chatelier	Paris
Wilhelm Ostwald	Leipsic
William Henry Perkin	Oxford

Class I., Section IV.—*Technology and Engineering.*—5.

Ferdinand Foch	Paris
Joseph Jacques Césaire Joffre	Paris
Maurice d'Ocagne	Paris
Vsevolod Evgenievich Timonoff	Leningrad
William Cawthorne Unwin	London

Class II.—*Natural and Physiological Sciences.*—24.

Section I.—*Geology, Mineralogy, and Physics of the Globe.*—10.

Frank Dawson Adams . . . . . Montreal
Charles Barrois . . . . . Lille
Waldemar Christofer Brögger . . . . . Christiania
Viktor Goldschmidt . . . . . Heidelberg
Albert Heim . . . . . Zurich
John Horne . . . . . Edinburgh
Emmanuel de Margerie . . . . . Paris
Gustaf Adolf Frederik Molengraaff. . . . . Delft
Sir William Napier Shaw. . . . . London
Johan Herman Lie Vogt. . . . . Trondhjem

Class II., Section II.—*Botany.*—5.

John Briquet . . . . . Geneva
Adolf Engler . . . . . Berlin
Ignatz Urban . . . . . Berlin
Hugo de Vries. . . . . Luntern
Richard Wettstein. . . . . Vienna

Class II., Section III.—*Zoology and Physiology.*—4.

George Albert Boulenger. . . . . Brussels
Maurice Caullery. . . . . Paris
Sir Edwin Ray Lankester . . . . . London
George Henry Falkiner Nuttall. . . . . Cambridge

Class II., Section IV.—*Medicine and Surgery.*—5.

Henry Hallett Dale . . . . . London
Sir Thomas Barlow, Bart. . . . . London
Friedrich von Müller. . . . . Munich
Francis John Shepherd . . . . . Montreal
Sir Charles Scott Sherrington . . . . . Oxford

Class III.—*Moral and Political Sciences.*—21.

Section I.—*Theology, Philosophy, and Jurisprudence.*—5.

Rt. Hon. Arthur James Balfour, Earl of Balfour . . . Prestonkirk
Francis Crawford Burkitt . . . . . Cambridge

Raymond Poincaré . . . . . Paris
Rt. Hon. Sir Frederick Pollock, Bart. . . . . London
Joseph Redlich. . . . . Vienna

Class III., Section II.—*Philology and Archaeology.*—7.

Wilhelm Dörpfeld. . . . . Athens
Karl Friedrich Geldner . . . . . Marburg
Henri Guy. . . . . Grenoble
Hermann Georg Jacobi . . . . . Bonn
Arthur Anthony Macdonell . . . . . Oxford
Alfred Percival Maudslay . . . . . Hereford
Ramon Menendez Pidal . . . . . Madrid

Class III., Section III.—*Political Economy and History.*—4.

Léon Duguit . . . . . Bordeaux
Adolf Harnack . . . . . Berlin
Henri Pirenne. . . . . Ghent
Rt. Hon. Sir George Otto Trevelyan, Bart. . . . . London

Class III., Section IV.—*Literature and the Fine Arts.*—5.

Jean Adrien Antoine Jules Jusserand . . . . . Paris
Rudyard Kipling . . . . . Burwash
Victor Laloux . . . . . Paris
Gilbert Murray . . . . . Oxford
Henri Rabaud. . . . . Paris

INDEX OF MEMBERS

The letters A, F, and FHM refer to the lists of Associates, Fellows, and Foreign Honorary Members, respectively. The class and section are indicated by the numerals following.

STATUTES AND STANDING VOTES.

STATUTES.

Adopted November 8, 1911. *amended May* 8, 1912, *January* 8, *and May* 14, 1913, *April* 14, 1915, *April* 12, 1916, *April* 10, 1918, *May* 14, 1919, *February* 8, *April* 12, *and December* 13, 1922, *February* 14, *March* 14, *and October* 10, 1923, *and March* 10, 1926.

CHAPTER I.

The Corporate Seal.

Article 1. The Corporate Seal of the Academy shall be as here depicted:

Article 2. The Recording Secretary shall have the custody of the Corporate Seal.

See Chap. v, art. 3; chap. vi, art. 2.

CHAPTER II.

Fellows and Foreign Honorary Members and Dues.

Article 1. The Academy consists of Fellows, who are either citizens or residents of the United States of America, and Foreign Honorary Members. They are arranged in three Classes, according to the Arts and Sciences in which they are severally proficient, and each Class is divided into four Sections, namely:

Class I. *The Mathematical and Physical Sciences*

Section 1. Mathematics and Astronomy
Section 2. Physics
Section 3. Chemistry
Section 4. Technology and Engineering

Class II. *The Natural and Physiological Sciences*

Section 1. Geology, Mineralogy, and Physics of the Globe
Section 2. Botany
Section 3. Zoölogy and Physiology
Section 4. Medicine and Surgery

Class III. *The Moral and Political Sciences*

Section 1. Theology, Philosophy, and Jurisprudence
Section 2. Philology and Archæology
Section 3. Political Economy and History
Section 4. Literature and the Fine Arts

Article 2. The number of Fellows shall not exceed Six hundred, of whom not more then Four hundred shall be residents of Massachusetts, nor shall there be more than Two hundred and ten in any one Class.

Article 3. The number of Foreign Honorary Members shall not exceed Seventy-five. They shall be chosen from among citizens of foreign countries most eminent for their discoveries and attainments in any of the Classes above enumerated. There shall not be more than Twenty-five in any one Class.

ARTICLE 4. If any person, after being notified of his election as Fellow, shall neglect for six months to accept in writing, or, if a Fellow resident within fifty miles of Boston shall neglect to pay his Admission Fee, his election shall be void; and if any Fellow resident within fifty miles of Boston shall neglect to pay his Annual Dues for six months after they are due, provided his attention shall have been called to this Article of the Statutes in the meantime, he shall cease to be a Fellow; but the Council may suspend the provisions of this Article for a reasonable time.

With the previous consent of the Council, the Treasurer may dispense (*sub silentio*) with the payment of the Admission Fee or of the Annual Dues or both whenever he shall deem it advisable. In the case of officers of the Army or Navy who are out of the Commonwealth on duty, payment of the Annual Dues may be waived during such absence if continued during the whole financial year and if notification of such expected absence be sent to the Treasurer. Upon similar notification to the Treasurer, similar exemption may be accorded to Fellows subject to Annual Dues, who may temporarily remove their residence for at least two years to a place more than fifty miles from Boston.

If any person elected a Foreign Honorary Member shall neglect for six months after being notified of his election to accept in writing, his election shall be void.

See Chap. vii, art. 2.

ARTICLE 5. Every Fellow resident within fifty miles of Boston hereafter elected shall pay an Admission Fee of Ten dollars.

Every Fellow resident within fifty miles of Boston shall, and others may, pay such Annual Dues, not exceeding Fifteen dollars, as shall be voted by the Academy at each Annual Meeting, when they shall become due; but any Fellow shall be exempt from the annual payment if, at any time after his admission, he shall pay into the treasury Two hundred dollars in addition to his previous payments. Any Fellow shall also be exempt from Annual Dues who has paid such dues for forty years, or, having attained the age of seventy-five, has paid dues for twenty-five years.

All Commutations of the Annual Dues shall be and remain permanently funded, the interest only to be used for current expenses.

Any Fellow not previously subject to Annual Dues who takes up his residence within fifty miles of Boston, shall pay to the Treasurer within three months thereafter Annual Dues for the current year, failing which his Fellowship shall cease; but the Council may suspend the provisions of this Article for a reasonable time.

Only Fellows who pay Annual Dues or have commuted them may hold office in the Academy or serve on the Standing Committees or vote at meetings.

Article 6. Fellows who pay or have commuted the Annual Dues and Foreign Honorary Members shall be entitled to receive gratis one copy of all Publications of the Academy issued after their election.

See Chap. xi, art. 2.

Article 7. Diplomas signed by the President and the Vice-President of the Class to which the member belongs, and countersigned by the Secretaries, shall be given to Foreign Honorary Members and to Fellows on request.

Article 8. If, in the opinion of a majority of the entire Council, any Fellow or Foreign Honorary Member shall have rendered himself unworthy of a place in the Academy, the Council shall recommend to the Academy the termination of his membership; and if three-fourths of the Fellows present, out of a total attendance of not less than fifty at a Stated Meeting, or at a Special Meeting called for the purpose, shall adopt this recommendation, his name shall be stricken from the Roll.

See Chap. iii; chap. vi, art. 1; chap. x, art. 1, 7; chap. xi, art. 2.

CHAPTER III.

Election of Fellows and Foreign Honorary Members

The procedure in the election of Fellows and Foreign Honorary Members shall be as follows:

Nominations to Fellowship or Foreign Honorary Membership in any Section must be signed by two Fellows of that Section, or by three Fellows of any Sections, and sent to the Corresponding Secretary ac-

companied by a statement of the qualifications of the nominee and brief biographical data.

Notice shall be sent to every Fellow not later than the fifteenth of January in each year, reminding him that all nominations must be in the hands of the Corresponding Secretary before the fifteenth of February following.

A list of the nominees, giving a brief account of each, with the names of the nominators, shall be sent to every Fellow with a request that he return the list with such confidential comments and indications of preference as he may choose to make.

All the nominations, with any comments thereon and with expressions of preference on the part of the Fellows, shall be referred to the appropriate Class Committees, which shall canvass them, and report their recommendations in writing to the Council before the Stated Meeting of the Academy in April.

Elections of Fellows and Foreign Honorary Members shall be made by the Council before the Annual Meeting in May, and announced at that meeting.

Persons nominated in any year, but not elected, may be carried over to the list of nominees for the next year at the discretion of the Council, but shall not be further continued unless renominated.

See Chap. ii; chap. vi, art. 1; chap. x, art. 1.

CHAPTER IV.

Officers.

Article 1. The Officers of the Academy shall be a President (who shall be Chairman of the Council), three Vice-Presidents (one from each Class), a Corresponding Secretary (who shall be Secretary of the Council), a Recording Secretary, a Treasurer, a Librarian, and an Editor, all of whom shall be elected by ballot at the Annual Meeting, and shall hold their respective offices for one year, and until others are duly chosen and installed.

There shall be also twelve Councillors, one from each Section of each Class. At each Annual Meeting three Councillors, one from each Class, shall be elected by ballot to serve for the full term of four

years and until others are duly chosen and installed. The same Fellow shall not be eligible for two successive terms.

The Councillors, with the other officers previously named, and the Chairman of the House Committee, *ex officio*, shall constitute the Council.

See Chap. xi, art. 1.

ARTICLE 2. If any officer be unable, through death, absence, or disability, to fulfil the duties of his office, or if he shall resign, his place may be filled by the Council in its discretion for any part or the whole of the unexpired term.

ARTICLE 3. At the Stated Meeting in March, the President shall appoint a Nominating Committee of three Fellows having the right to vote, one from each Class. This Committee shall prepare a list of nominees for the several offices to be filled, and for the Standing Committees, and file it with the Recording Secretary not later than four weeks before the Annual Meeting.

See Chap. vi, art. 2.

ARTICLE 4. Independent nominations for any office, if signed by at least twenty Fellows having the right to vote, and received by the Recording Secretary not less than ten days before the Annual Meeting, shall be inserted in the call therefor, and shall be mailed to all the Fellows having the right to vote.

See Chap. vi, art. 2.

ARTICLE 5. The Recording Secretary shall prepare for use in voting at the Annual Meeting a ballot containing the names of all persons duly nominated for office.

CHAPTER V.

THE PRESIDENT.

ARTICLE 1. The President, or in his absence the senior Vice-President present (seniority to be determined by length of continuous fellowship in the Academy), shall preside at all meetings of the Acad-

emy. In the absence of all these officers, a Chairman of the meeting shall be chosen by ballot.

ARTICLE 2. Unless otherwise ordered, all Committees which are not elected by ballot shall be appointed by the presiding officer.

ARTICLE 3. Any deed or writing to which the Corporate Seal is to be affixed, except leases of real estate, shall be executed in the name of the Academy by the President or, in the event of his death, absence, or inability, by one of the Vice-Presidents, when thereto duly authorized.

See Chap. ii, art. 7; chap. iv, art. 1, 3; chap. vi, art. 2; chap. vii, art. 1; chap. x, art. 6; chap. xi, art. 1, 2; chap. xii, art. 1.

CHAPTER VI.

THE SECRETARIES.

ARTICLE 1. The Corresponding Secretary shall conduct the correspondence of the Academy and of the Council, recording or making an entry of all letters written in its name, and preserving for the files all official papers which may be received. At each meeting of the Council he shall present the communications addressed to the Academy which have been received since the previous meeting, and at the next meeting of the Academy he shall present such as the Council may determine.

He shall notify all persons who may be elected Fellows or Foreign Honorary Members, send to each a copy of the Statutes, and on their acceptance issue the proper Diploma. He shall also notify all meetings of the Council; and in case of the death, absence, or inability of the Recording Secretary he shall notify all meetings of the Academy.

Under the direction of the Council, he shall keep a List of the Fellows and Foreign Honorary Members, arranged in their several Classes and Sections. It shall be printed annually and issued as of the first day of July.

See Chap. ii, art. 7; chap. iii, art. 2, 3; chap. iv, art. 1; chap. x, art. 6; chap. xi, art. 1; chap. xii, art. 1.

ARTICLE 2. The Recording Secretary shall have the custody of the Charter, Corporate Seal, Archives, Statute-Book, Journals, and all literary papers belonging to the Academy.

Fellows borrowing such papers or documents shall receipt for them to their custodian.

The Recording Secretary shall attend the meetings of the Academy and keep a faithful record of the proceedings with the names of the Fellows present; and after each meeting is duly opened, he shall read the record of the preceding meeting.

He shall notify the meetings of the Academy to each Fellow and by mail at least seven days beforehand, and in his discretion may also cause the meetings to be advertised; he shall apprise Officers and Committees of their election or appointment, and inform the Treasurer of appropriations of money voted by the Academy.

After all elections, he shall insert in the Records the names of the Fellows by whom the successful nominees were proposed.

He shall send the Report of the Nominating Committee in print to every Fellow having the right to vote at least three weeks before the Annual Meeting.

See Chap. iv, art. 3.

In the absence of the President and of the Vice-Presidents he shall, if present, call the meeting to order, and preside until a Chairman is chosen.

See Chap. i; chap. ii, art. 7; chap. iv, art. 3, 4, 5; chap. x, art. 6; chap. xi, art. 1, 2; chap. xii, art. 1, 3.

ARTICLE 3. The Secretaries, with the Editor, shall have authority to publish such of the records of the meetings of the Academy as may seem to them likely to promote its interests.

CHAPTER VII.

THE TREASURER AND THE TREASURY.

ARTICLE 1. The Treasurer shall collect all money due or payable to the Academy, and all gifts and bequests made to it. He shall pay all bills due by the Academy, when approved by the proper officers, except those of the Treasurer's office, which may be paid without such approval; in the name of the Academy he shall sign all leases of real estate; and, with the written consent of a member of the Committee

on Finance, he shall make all transfers of stocks, bonds, and other securities belonging to the Academy, all of which shall be in his official custody.

He shall keep a faithful account of all receipts and expenditures, submit his accounts annually to the Auditing Committee, and render them at the expiration of his term of office, or whenever required to do so by the Academy or the Council.

He shall keep separate accounts of the income of the Rumford Fund, and of all other special Funds, and of the appropriation thereof, and render them annually.

His accounts shall always be open to the inspection of the Council.

ARTICLE 2. He shall report annually to the Council at its March meeting on the expected income of the various Funds and from all other sources during the ensuing financial year. He shall also report the names of all Fellows who may be then delinquent in the payment of their Annual Dues.

ARTICLE 3. He shall give such security for the trust reposed in him as the Academy may require.

ARTICLE 4. With the approval of a majority of the Committee on Finance, he may appoint an Assistant Treasurer to perform his duties, for whose acts, as such assistant, he shall be responsible; or, with like approval and responsibility, he may employ any Trust Company doing business in Boston as his agent for the same purpose, the compensation of such Assistant Treasurer or agent to be fixed by the Committee on Finance and paid from the Funds of the Academy.

ARTICLE 5. At the Annual Meeting he shall report in print all his official doings for the preceding year, stating the amount and condition of all the property of the Academy entrusted to him, and the character of the investments.

ARTICLE 6. The Financial Year of the Academy shall begin with the first day of April.

ARTICLE 7. No person or committee shall incur any debt or liability in the name of the Academy, unless in accordance with a

previous vote and appropriation therefor by the Academy or the Council, or sell or otherwise dispose of any property of the Academy, except cash or invested funds, without previous consent and approval of the Council.

See Chap. ii, art. 4, 5; chap. vi, art. 2; chap. x, art. 6; chap. xi, art. 1, 2, 3; chap. xii, art. 1.

CHAPTER VIII.

The Librarian and the Library.

Article 1. The Librarian shall have charge of the printed books, keep a correct catalogue thereof, and provide for their delivery from the Library.

At the Annual Meeting, as Chairman of the Committee on the Library, he shall make a Report on its condition.

Article 2. In conjunction with the Committee on the Library he shall have authority to expend such sums as may be appropriated by the Academy for the purchase of books, periodicals, etc., and for defraying other necessary expenses connected with the Library.

Article 3. All books procured from the income of the Rumford Fund or of other special Funds shall contain a book-plate expressing the fact.

Article 4. Books taken from the Library shall be receipted for to the Librarian or his assistant.

Article 5. Books shall be returned in good order, regard being had to necessary wear with good usage. If any book shall be lost or injured, the Fellow to whom it stands charged shall replace it by a new volume or by a new set, if it belongs to a set, or pay the current price thereof to the Librarian, whereupon the remainder of the set, if any, shall be delivered to the Fellow so paying, unless such remainder be valuable by reason of association.

Article 6. All books shall be returned to the Library for examination at least one week before the Annual Meeting.

ARTICLE 7. The Librarian shall have the custody of the Publications of the Academy. With the advice and consent of the President, he may effect exchanges with other associations.

See Chap. ii, art. 6; chap. xi, art. 1, 2.

CHAPTER IX.

THE EDITOR AND THE PUBLICATIONS.

ARTICLE 1. The Editor shall have charge of the conduct through the press of the Proceedings and the Memoirs, and all correspondence relative thereto, and shall have power to fix the price at which individual numbers of the Proceedings and Memoirs are sold.

ARTICLE 2. In conjunction with the Committee of Publication, he shall have authority to expend such sums as may be appropriated by the Academy for printing the publications and for defraying other expenses therewith connected.

ARTICLE 3. All publications which are financed in whole or in part from the income of the Rumford Fund or from the income of other special funds, and all publications of work done with the aid of the Rumford Fund or other special funds, shall contain a conspicuous statement of this fact.

ARTICLE 4. Two hundred extra copies of each paper printed in the Proceedings or Memoirs shall be placed at the disposal of the author without charge.

If, on account of the number of communications offered for publication, it shall be necessary to decline for publication communications otherwise acceptable, members of the Academy shall be given preference in each of the several Classes over non-members; but whenever it shall be necessary to exercise this preference, the Editor shall inform the Council of the fact.

See Chap. iv, art. 1; chap. vi, art. 3; chap. x, art. 6; chap. xi, art. 4.

CHAPTER X.

The Council.

Article 1. The Council shall exercise a discreet supervision over all nominations and elections to membership, and in general supervise all the affairs of the Academy not explicitly reserved to the Academy as a whole or entrusted by it or by the Statutes to standing or special committees.

It shall consider all nominations duly sent to it by any Class Committee, and act upon them in accordance with the provisions of Chapter III.

With the consent of the Fellow interested, it shall have power to make transfers between the several Sections, reporting its action to the Academy.

See Chap. iii, art. 2, 3; chap. xi, art. 1.

Article 2. Seven members shall constitute a quorum.

Article 3. It shall establish rules and regulations for the transaction of its business, and provide all printed and engraved blanks and books of record.

Article 4. It shall act upon all resignations of officers, and all resignations and forfeitures of Fellowship; and cause the Statutes to be faithfully executed.

It shall appoint all agents and subordinates not otherwise provided for by the Statutes, prescribe their duties, and fix their compensation. They shall hold their respective positions during the pleasure of the Council.

Article 5. It may appoint, for terms not exceeding one year, and prescribe the functions of, such committees of its number, or of the Fellows of the Academy, as it may deem expedient, to facilitate the administration of the affairs of the Academy or to promote its interests.

Article 6. At its March meeting it shall receive reports from the President, the Secretaries, the Treasurer, and the Standing Commit-

tees, on the appropriations severally needed for the ensuing financial year. At the same meeting the Treasurer shall report on the expected income of the various Funds and from all other sources during the same year.

A report from the Council shall be submitted to the Academy, for action, at the March meeting, recommending the appropriation which in the opinion of the Council should be made.

On the recommendation of the Council, special appropriations may be made at any Stated Meeting of the Academy, or at a Special Meeting called for the purpose.

See Chap. xi, art. 3.

ARTICLE 7. After the death of a Fellow or Foreign Honorary Member, it shall appoint a member of the Academy to prepare a biographical notice for publication in the Proceedings.

ARTICLE 8. It shall report at every meeting of the Academy such business as it may deem advisable to present.

See Chap. ii, art. 4, 5, 8; chap. iv, art. 1, 2; chap. vi, art. 1; chap. vii, art. 1; chap. xii, art. 1, 4.

CHAPTER XI.

STANDING COMMITTEES.

ARTICLE 1. The Class Committee of each Class shall consist of the Vice-President, who shall be chairman, and the four Councillors of the Class, together with such other officer or officers annually elected as may belong to the Class. It shall consider nominations to Fellowship in its own Class, and report in writing to the Council such as may receive at a Class Committee Meeting a majority of the votes cast, provided at least three shall have been in the affirmative.

See Chap. iii, art. 2.

ARTICLE 2. At the Annual Meeting the following Standing Committees shall be elected by ballot to serve for the ensuing year:

(i) *The Committee on Finance*, to consist of three Fellows, who, through the Treasurer, shall have full control and management of the

funds and trusts of the Academy, with the power of investing the funds and changing the investments thereof in their discretion.

See Chap. iv, art. 3; chap. vii, art. 1, 4; chap. x, art. 6.

(ii) *The Rumford Committee*, to consist of seven Fellows, who shall report to the Academy on all applications and claims for the Rumford Premium. It alone shall authorize the purchase of books, publications and apparatus at the charge of the income from the Rumford Fund, and generally shall see to the proper execution of the trust.

See Chap. iv, art. 3; chap. x, art. 6.

(iii) *The Cyrus Moors Warren Committee*, to consist of seven Fellows, who shall consider all applications for appropriations from the income of the Cyrus Moors Warren Fund, and generally shall see to the proper execution of the trust.

See Chap. iv, art. 3; chap. x, art. 6.

(iv) *The Committee of Publication*, to consist of the Editor, *ex officio*, as Chairman, and three other Fellows, one from each Class, to whom all communications submitted to the Academy for publication shall be referred, and to whom the printing of the Proceedings and the Memoirs shall be entrusted.

It shall fix the price at which volumes of the publications shall be sold; but Fellows may be supplied at half price with volumes which may be needed to complete their sets, but which they are not entitled to receive gratis.

It shall determine when the pressure of material offered for publication makes it necessary to give preference to members of the Academy as compared with non-members, or to give priority to certain members as compared with others, and to what extent this preference or priority shall be applied in each of the three Classes, to the end that a proper balance of the facilities of publication with respect to subject matter and authors may be maintained.

See Chap. iv, art. 3; chap. vi, art. 1, 3; chap. ix; chap. x, art. 6.

(v) *The Committee on the Library*, to consist of the Librarian, *ex officio*, as Chairman, and three other Fellows, one from each Class,

who shall examine the Library and make an annual report on its condition and management.

See Chap. iv, art. 3; chap. viii, art. 1, 2; chap. x, art. 6.

(vi) *The House Committee*, to consist of three Fellows, who shall have charge of all expenses connected with the House, including the general expenses of the Academy not specifically assigned to the care of other Committees or Officers.

See Chap. iv, art. 1, 3; chap. x, art. 6.

(vii) *The Committee on Meetings*, to consist of the President, the Recording Secretary, and three other Fellows, who shall have charge of plans for meetings of the Academy.

See Chap. iv, art. 3; chap. x, art. 6.

(viii) *The Auditing Committee*, to consist of two Fellows, who shall audit the accounts of the Treasurer, with power to employ an expert and to approve his bill.

See Chap. iv, art. 3; chap. vii, art. 1; chap. x, art. 6.

ARTICLE 3. The Standing Committees shall report annually to the Council in March on the appropriations severally needed for the ensuing financial year; and all bills incurred on account of these Committees, within the limits of the several appropriations made by the Academy, shall be approved by their respective Chairmen.

In the absence of the Chairman of any Committee, bills may be approved by any member of the Committee whom he shall designate for the purpose.

See Chap. vii, art. 1, 7; chap. x, art. 6.

CHAPTER XII.

MEETINGS, COMMUNICATIONS, AND AMENDMENTS.

ARTICLE 1. There shall be annually eight Stated Meetings of the Academy, namely, on the second Wednesday of October, November, December, January, February, March, April, and May. Only at these meetings, or at adjournments thereof regularly notified, or at

Special Meetings called for the purpose, shall appropriations of money be made or amendments of the Statutes or Standing Votes be effected.

The Stated Meeting in May shall be the Annual Meeting of the Corporation.

Special Meetings shall be called by either of the Secretaries at the request of the President, of a Vice-President, of the Council, or of ten Fellows having the right to vote; and notifications thereof shall state the purpose for which the meeting is called.

A meeting for receiving and discussing literary or scientific communications may be held on the fourth Wednesday of each month, excepting July, August, and September; but no business shall be transacted at said meetings.

ARTICLE 2. Twenty Fellows having the right to vote shall constitute a quorum for the transaction of business at Stated or Special Meetings. Fifteen Fellows shall be sufficient to constitute a meeting for literary or scientific communications and discussions.

ARTICLE 3. Upon the request of the presiding officer or the Recording Secretary, any motion or resolution offered at any meeting shall be submitted in writing.

ARTICLE 4. No report of any paper presented at a meeting of the Academy shall be published by any Fellow without the consent of the author; and no report shall in any case be published by any Fellow in a newspaper as an account of the proceedings of the Academy without the previous consent and approval of the Council. The Council, in its discretion, by a duly recorded vote, may delegate its authority in this regard to one or more of its members.

ARTICLE 5. No Fellow shall introduce a guest at any meeting of the Academy until after the business has been transacted, and especially until after the result of the balloting upon nominations has been declared.

ARTICLE 6. The Academy shall not express its judgment on literary or scientific memoirs or performances submitted to it, or included in its Publications.

ARTICLE 7. All proposed Amendments of the Statutes shall be referred to a committee, and on its report, at a subsequent Stated Meeting or at a Special Meeting called for the purpose, two-thirds of the ballot cast, and not less than twenty, must be affirmative to effect enactment.

ARTICLE 8. Standing Votes may be passed, amended, or rescinded at a Stated Meeting, or at a Special Meeting called for the purpose, by a vote of two-thirds of the members present. They may be suspended by a unanimous vote.

See Chap. ii, art. 5, 8; chap. iii; chap. iv, art. 3, 4, 5; chap. v, art. 1; chap. vi, art. 1, 2; chap. x, art. 8.

STANDING VOTES.

1. Communications of which notice has been given to either of the Secretaries shall take precedence of those not so notified.

2. Fellows may take from the Library six volumes at any one time, and may retain them for three months, and no longer. Upon special application, and for adequate reasons assigned, the Librarian may permit a larger number of volumes, not exceeding twelve, to be drawn from the Library for a limited period.

3. Works published in numbers, when unbound, shall not be taken from the Hall of the Academy without the leave of the Librarian.

4. The Council, under such rules respecting nominations as it may prescribe, may elect as Associates of the Academy a limited number of men of mark in affairs or of distinguished service in the community.

Associates shall be entitled to the same privileges as Fellows, but shall not have the right to vote.

The admission fee and annual dues of Associates shall be the same as those of Fellows residing within fifty miles of Boston.

5. Communications offered for publication in the Proceedings or Memoirs of the Academy shall not be accepted for publication before the author shall have informed the Committee on Meetings of his readiness, either himself or through some agent, to use such time as the Committee may assign him at such meeting as may be convenient both to him and to the Committee, for the purpose of presenting to the Academy a general statement of the nature and significance of the results contained in his communication.

RUMFORD PREMIUM.

In conformity with the terms of the gift of Sir Benjamin Thompson, Count Rumford, of a certain Fund to the American Academy of Arts and Sciences, and with a decree of the Supreme Judicial Court of Massachusetts for carrying into effect the general charitable intent and purpose of Count Rumford, as expressed in his letter of gift, the Academy is empowered to make from the income of the Rumford Fund, as it now exists, at any Annual Meeting, an award of a gold and a silver medal, being together of the intrinsic value of three hundred dollars, as a Premium to the author of any important discovery or useful improvement in light or heat, which shall have been made and published by printing, or in any way made known to the public, in any part of the continent of America, or any of the American islands; preference always being given to such discoveries as, in the opinion of the Academy, shall tend most to promote the good of mankind; and, if the Academy sees fit, to add to such medals, as a further Premium for such discovery and improvement, a sum of money not exceeding three hundred dollars.

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